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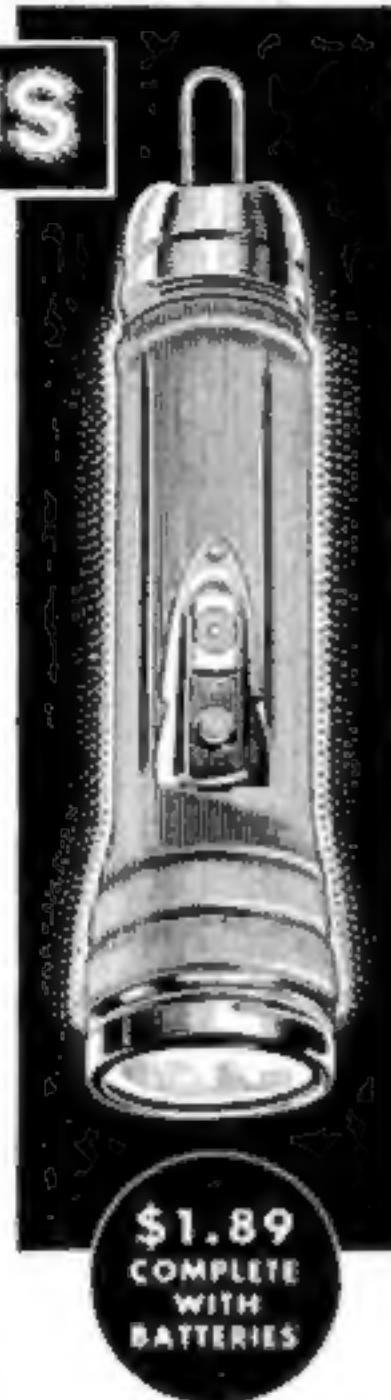
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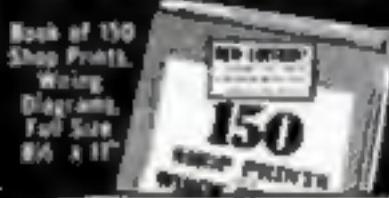
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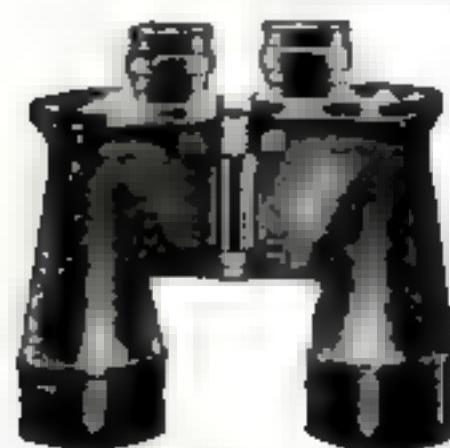
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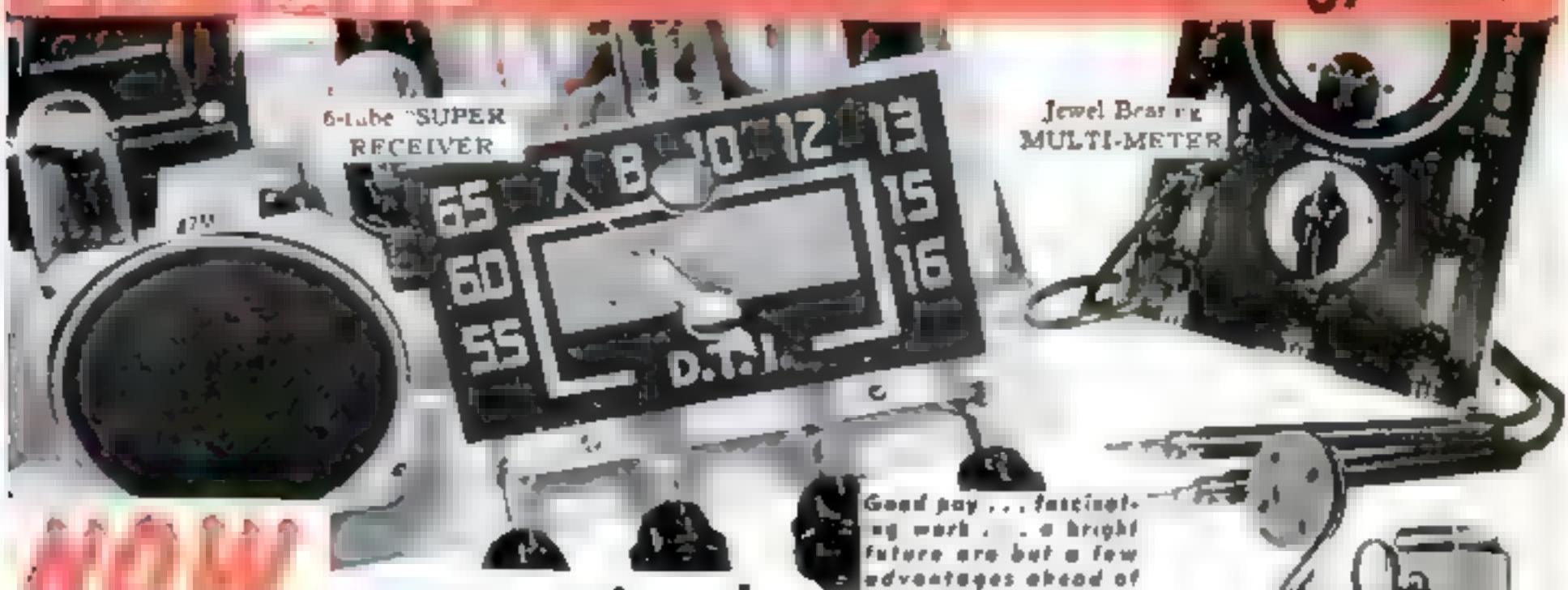
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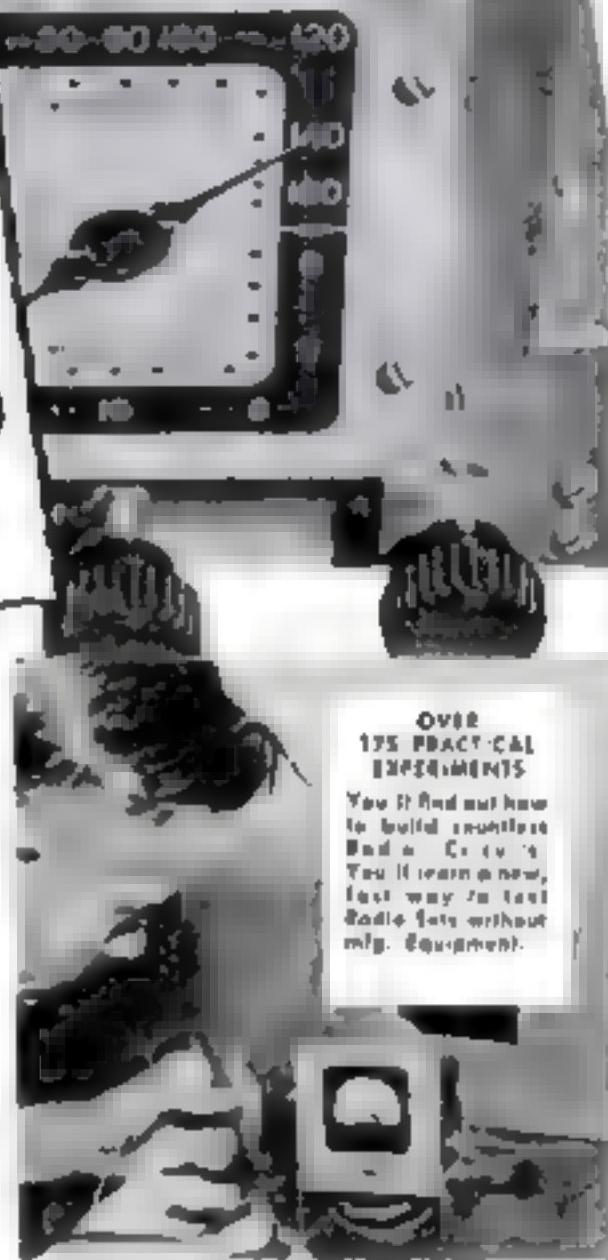
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Letters



PS in Safety Program

Sir:

I would like your permission to make about thirty photostatic copies of the article "Danger 115 Volts," which appears on pages 186 to 189 of the January issue of POPULAR SCIENCE. These copies would be for distribution among employees in our electrical department as part of our safety program.

E. V. LINDSETH

U. S. Department of the Interior
South Platte River District
Denver, Colo.

PS is happy to take part in this valuable safety-training program.

What a Memory!

Sir:

Some time ago you published a description of an easily constructed device to demonstrate the incandescent point of iron, by means of a heated wire and pointer. The author of the description was Raymond B. Wailes. Results were perfect if you followed directions. Without the right dimensions it was one of those things that you can work on for a year without success.

If you are able to give me the article I would appreciate it very much.

J. HAROLD BYERS

Washington, D. C.

After some extensive head-scratching and page-thumbing, our library staff finally came up with the answer. The article was "Hot Metal Strangely Rekindles Dying Glow," September, 1935, page 51.

Old Spikes with a New Twist

Sir:

It may interest you that the article on page 105, May issue of Popular Science, titled "Rails Held Rigid" is nothing new in railroading. I have been working for the Erie Railroad for the past 19 years, and we have used this type of screw spike. We know them as lagg screws. We use the same method of starting those spikes, but we do not drive them all the way down. We set the spike with a hammer and then screw it

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Patent laws encourage the development of inventions.

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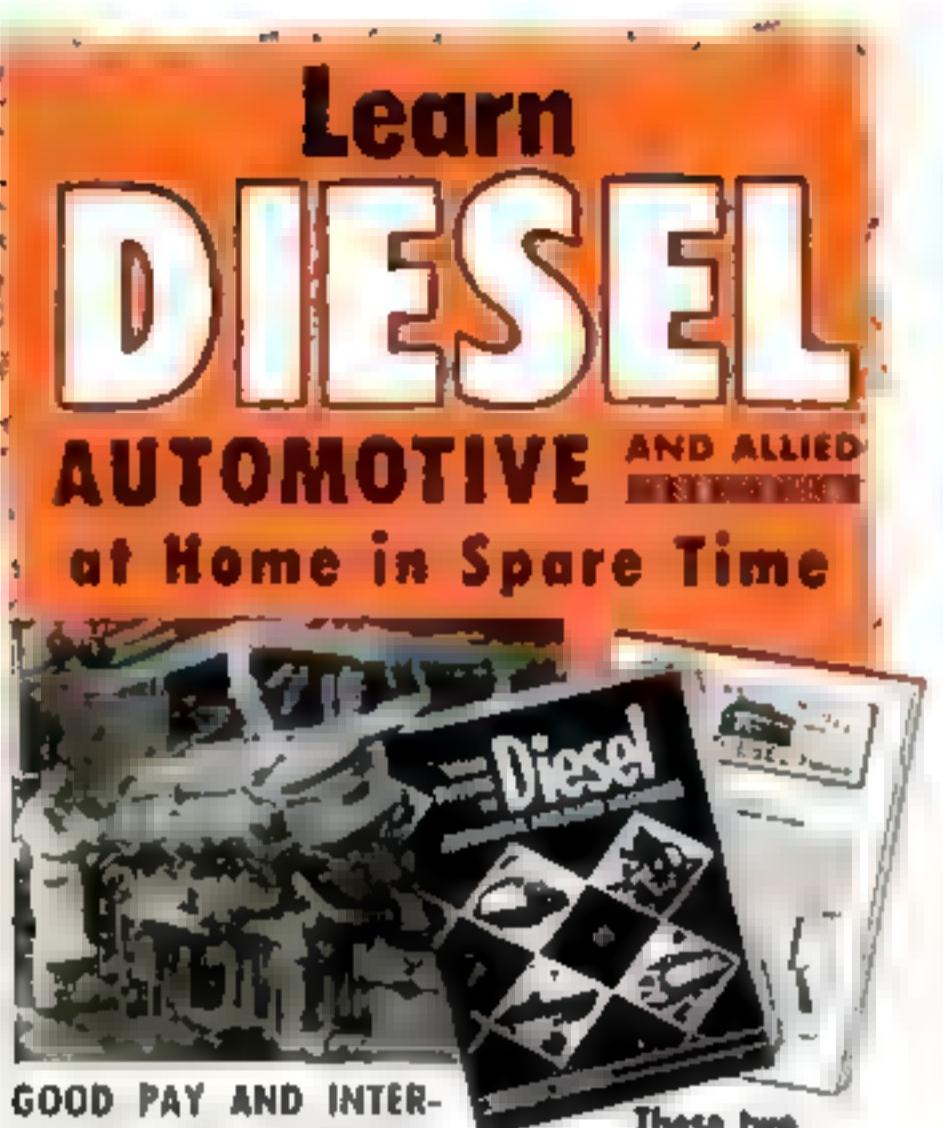
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down the rest of the way with a wrench. . . .

D. A. MECCA

Dunmore, Pa

Yes, but the newer spikes PS described do not have to be screwed in. They are hammered down and screw themselves in, saving time and work. That's the difference.

Patience Proves Its Virtue

Sir:

Enclosed, find a photo [below] of one of your home shopcraft projects.

I made it from a piece of scrap-iron 5"x1½". The finished anvil measures 4" long, ¾" top surface wide, base 1"x1½".

Being a maintenance mechanic in an Oregon shipyard, I had a little spare time between repairs on cranes, drill presses, etc.

Other than using a power hack-saw, I finished it to shape with a hand hack-saw and assorted files. . . .



As this is my only attempt of this nature, I would be thrilled and very pleased if you could find space to publish the picture to show it doesn't take power lathes, etc., to turn out a job, if one has patience.

EDW. PRATER

Pocatello, Idaho

Radioisotopes for World Peace

Sir:

The Department is preparing an educational photo exhibit and filmstrip on the general subject of the use of radioisotopes in research for distribution to its missions in countries outside the United States.

We should like to enlist your assistance in providing us with a selection of 8 x 10 glossy photographs, fully captioned, together with any descriptive material or articles

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HARRY S. CASLER

International Press and Publications Division
Department of State
Washington, D. C.

*PS is glad to be of help in this important
work and is sending Mr. Casler the informa-
tion he requests.*

Science vs. Art

Sir:

Cartoonist for Mrs. Bob Smith's "You Can't Pull Wool Over Baby's Head, etc." ["What's Your Ingenuity Quotient?" June '48, p. 161] must have visioned a freak woman with ability to make balloons float with human air. Idea is not a bad one tho'.

C. H. BARNES

Duluth, Minn.

*PS is guilty of taking slight liberties with
the laws of physics for the sake of art, but
the idea works just as well even though the
balloons won't float.*

More on Red and Green Air

Sir:

Regarding the standing wave (alias Mo-
zagot) ["Flying in Red and Green Air," PS,
July '48, p. 91] found mostly in the lee of
high mountain ranges, it is created by cold
air encountering a high mountain range. It
collects on the windward side until it reaches
high enough to flow through mountain
passes and finally over the entire range.

On the lee side it flows off creating a
precipice of cold air. Warmer air currents
(condition usually exists when there is an
inversion, hence the warm air) fall down
the precipice of cold air, then bounce up-
ward, creating large standing waves which
extend well into the stratosphere.

ALEXIS DAWYDOFF

Air Trails
New York, New York

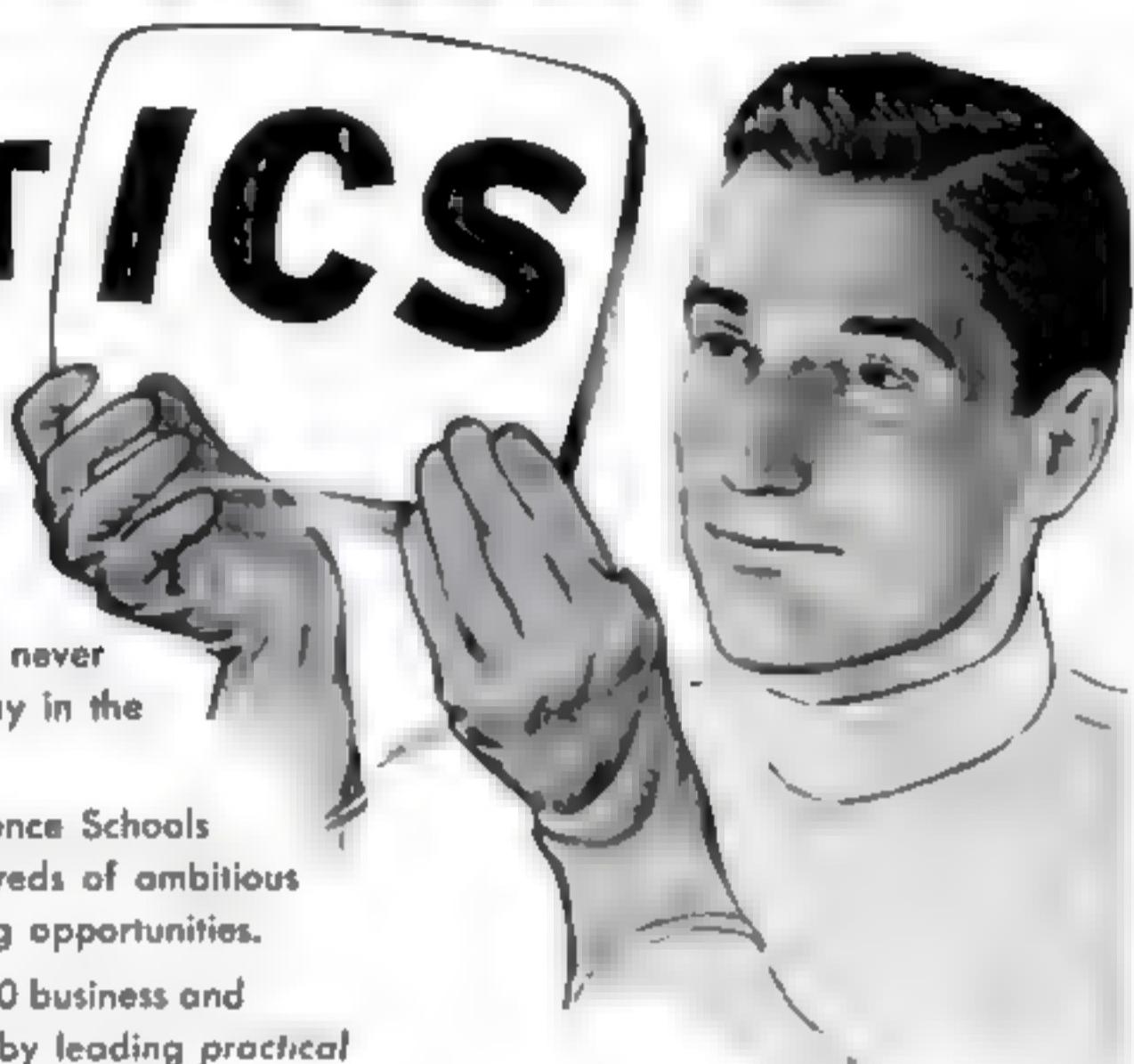
One on Galileo

Sir:

Regarding the argument in the June issue

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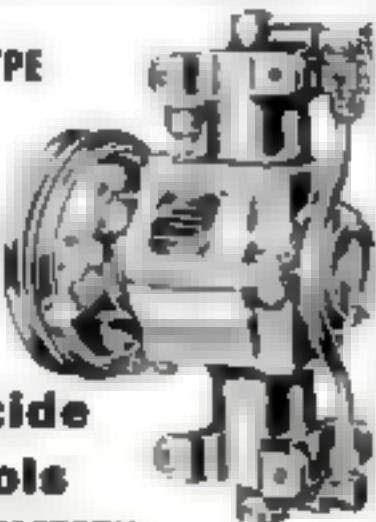
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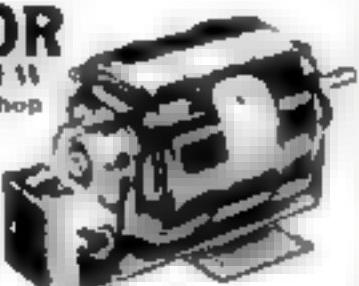
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[“Letters,” p. 20] about the weighted fountain pen cap, I would like to submit my conclusions from observed facts. Namely, that when I drop a slice of buttered bread it always lands buttered side down.

PAUL SWANSON

Flint, Michigan

Galileo should know, but perhaps he just never used butter on his bread.

Underwater Radar All Wet

Sir:

. . . I hate to be naive, but I would like to know what kind of radar discovered the mountain 2760 feet below the surface of the ocean [PS, June '48, p. 96]. Such a radar would be invaluable for anti-submarine work.

Exs. M. M. McLEOD, USN
USS Hugh Pervis, DD 709
New York, N. Y.

Radar can't penetrate water, but PS can, since it is obviously all wet. The mountain was found by a sound-echo detection device.

Quick Answer

Sir:

Being a subscriber of PS, I noticed in the March issue on page 112 a Mrs. W. Dunaway wishing for built-in washboards in laundry tubs.



Being employed by one of the largest plumbing manufacturers in the country, I know that this type of laundry tub [shown above] is made and has been for many years.

T. J. VON DRASEK
Brookfield, Ill.

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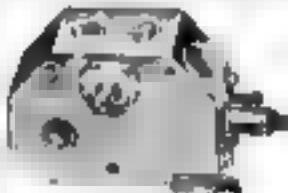
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2. Double action, 2 1/2" bore, 8" stroke. Will lift 4,000 lbs. in one second with Vickers Pump. Wt. 11 lbs. Will withstand 1500 P.S.I. against water. Wt. 7 lbs. A \$45.00 by freight by dealer value for us. **\$14.50** paid postpaid now.

3. Double action, 2" bore, 12" stroke. All steel hydraulic cylinder with Wt. lift up to 17,000 lbs. (7000 lbs. in 3 seconds with Vickers Pump). Wt. 12 lbs. A \$70.00 value for us. **\$19.50** paid postpaid now.

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4. Four-way control valve for use with two 1700 P.S.I. hydraulic cylinders. Inlet will lift one cylinder at a rate of 1 ft. per second while the other 1 ft. per second. Inlet valve of the cylinders to hold the piston at any pre-set position. Brand New. Ship. Wt. 6 lbs. A \$30.00 value for us. **\$10.95** paid postpaid now.

5. Same as valve Item 3 except that unit is designed for three double action cylinders. Brand New. Ship. Wt. 8 lbs. A \$72.00 value for us. **\$12.95** paid postpaid now.

6. A two cylinder double action valve with unique arrangement allowing the operator to use both cylinders simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand New. Ship. Wt. 8 lbs. A \$14.95 postpaid now.

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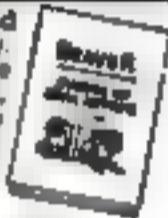
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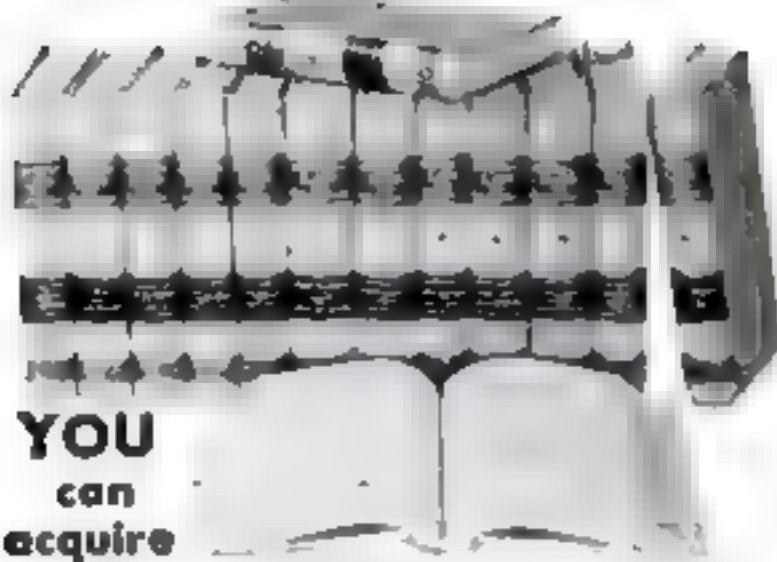
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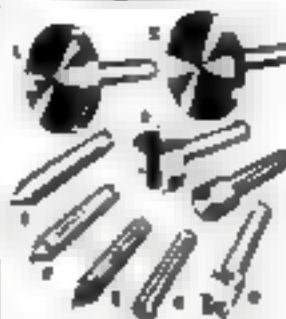
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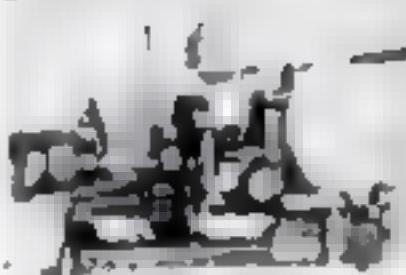


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A black and white photograph of a vintage-style car's front end, featuring a large chrome hood ornament and a prominent front grille. The car is positioned on the left side of the frame, with its front facing towards the right. To the right of the car is a vertical text box containing a poem.

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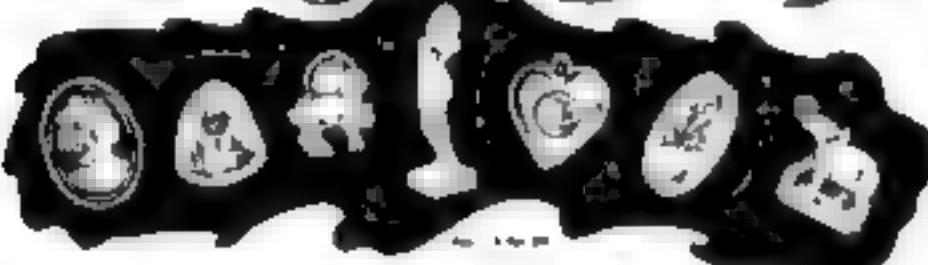
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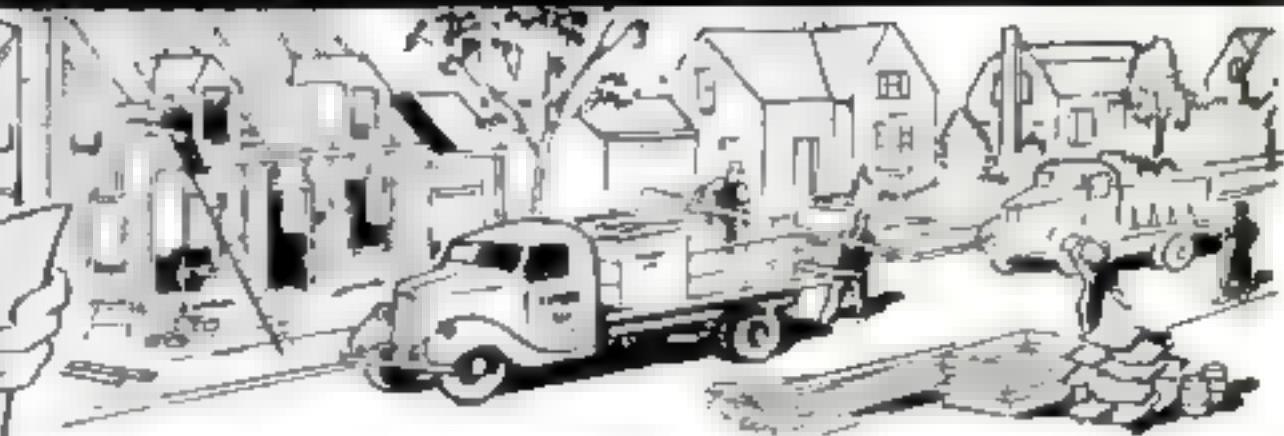
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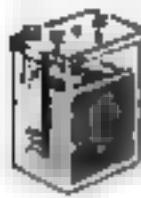
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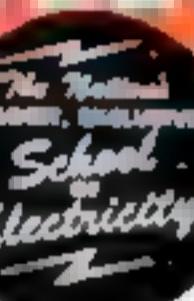
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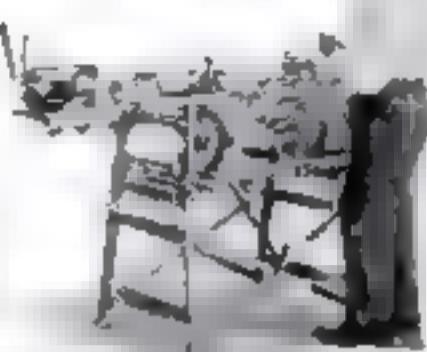
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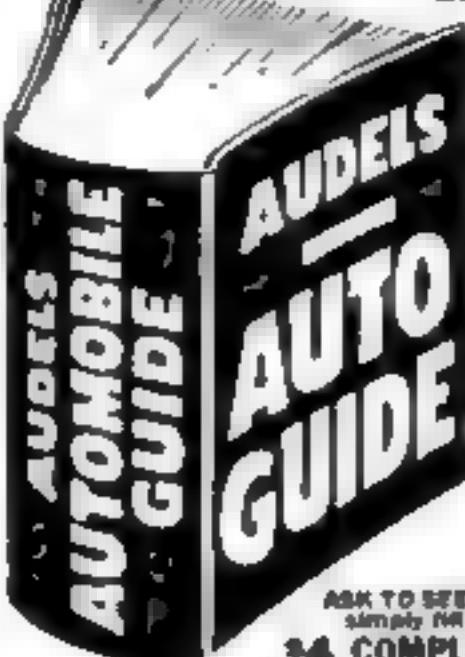
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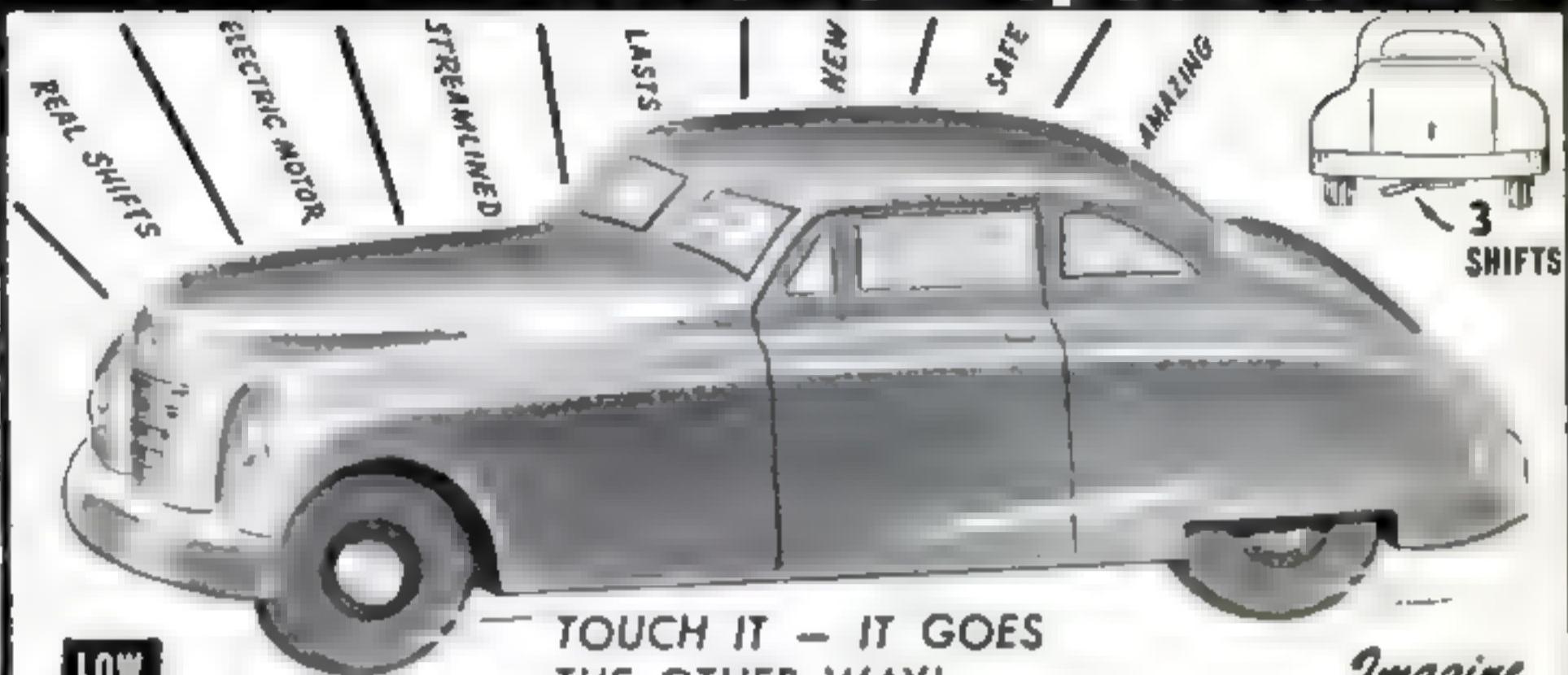
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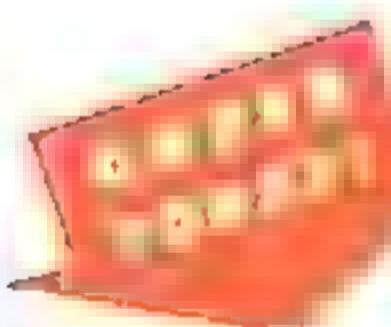
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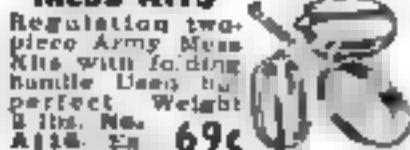
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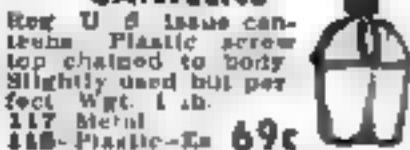
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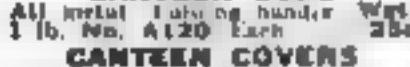
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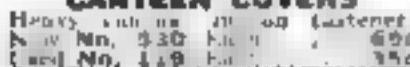
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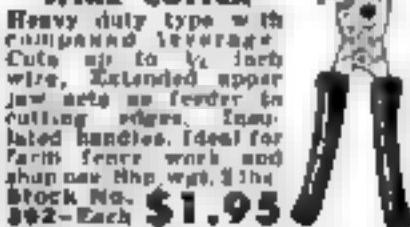
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"SHIP Model Making" big book that shows how to make galleon, clipper ship fittings, etc., only \$2.00. "Model Railways" complete instructions on making laying out operating your own scale layout \$2.49. Money back if not satisfied. Order O.O.D. or send remittance to Popular Science, Dept. 630, 363 4th Ave., New York 10 N.Y.

POW Sale: 43 volumes English "Model Engineer" \$100.00. Anton Bohaboy, 2297 Price, Rahway, N.J.

61 HOME CRAFTSMEN

LAWN chairs, garden figures, furniture, novelties, toys, etc. 88 popular plans with full size patterns. \$1.00. Mastercraft 88, 1041 Olcott Chicago 31, Ill.

SWISS Musical units \$2.75. Musical Albums, Boxes, 131 West 42nd, New York 18.

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COPPER and Brass Materials Complete line for Craftsmen and Workshops Catalog Free Groundmaster Company, Boulder Colorado.

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62 INVENTIONS AND PLANS

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63 BUILD IT FOR RAFFLE

STREAMLINED Built-in Kitchen cabinets to fit any kitchen. Complete, easy to understand directions and plans and specifications showing "professors" construction methods. All for \$1.00. Thoebert Co., Box 647A, Newton, Iowa.

INVENTORS—Patent laws encourage the development of inventions. Our firm is registered to practice before the U. S. Patent Office. Write for further particulars as to patent protection and procedure and "Invention Record" form at once. No obligation. McMorrow, Berman & Davidson Registered Patent Attorneys, 1438 Victor Building, Washington 1, D. C.

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67 TOBACCO & PIPE

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MAKE smoking pipes briar blocks and stems. Send for circular. Michaelson & Rosenberg, 23 West 47th Street, New York 10.

68 RAZOR BLADES, SHAVERS

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BORROW by mail. Loans \$50.00 to \$300.00 to employed men and women. Easy, quick. Completely private confidential. No endorsers. Repay in convenient monthly payments. Details free in plain envelope. Write State Finance Co., 120 Securities Bldg., Dept. H-14, Des Moines 9, Iowa.

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MAKE Friends everywhere. Copyrighted literature explains easy method. Free information mailed to single, interested persons. Write Strong, Box 157-PG, New York 11.

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105 ADVICE

CIGARETTE habit broken quickly pleasantly. Latest scientific method. Complete instructions \$1.00. Science A, Box 103, Canton 1, Ohio.

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SEEK Buried treasure; Methods, mysteries, devices explained. Circular free. Century Press, Box 151-D, Glen Ellyn, Ill.

M-SCOPE Metal Locator fully guaranteed and unsurpassed in efficiency. New featherweight models. Time payment plan. Free literature Fisher Research Laboratory, Inc., Palo Alto, Calif.

137 DETECTIVES

DETECTIVE Training Phillips Secret Service, 19170 N. Kenneth, Chicago 39, Ill.

DETECTIVES—Work home—Travel, Experience unnecessary. Write Wagoner P-123 West 86th, N.Y. N.Y.

142 INFORMATION

COSMIC RAYS discovery revolutionizes science, bringing telepathy instantaneous love and oneness! Startling book "Cosmic Rays and Cosmic Consciousness" (\$2.50) mailed on approval. Send no money. Finding inspiration courage strength success enlightenment ecstasy mail check otherwise return book pay nothing. Crane publisher Kingsport 1, Tenn.

143 NAME LISTS

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MAILING lists most classes 1000 \$5.00. Free Prospectus. Dixie Service King N.C.

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USE THIS ORDER FORM TO INCREASE YOUR MAIL ORDER BUSINESS

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To be inserted in the October issue, this order must reach us by August 23rd

EVERYTHING YOU WANT TO KNOW ABOUT RADIO IN THIS "2-VOLUME REFERENCE LIBRARY"!

A MOUNTAIN OF RADIO MATERIAL IN THESE TWO GIANT BOOKS!

Let these two great books show you how to build and repair all types of radios, FM receivers, portables, radio-phonographs, shortwave sets, high fidelity amplifiers, wireless record players and recorders! No matter what you want to know, you can find it in a jiffy in these two wonder volumes—for they take you from basic soldering and splicing to building big radio-phonograph combinations!

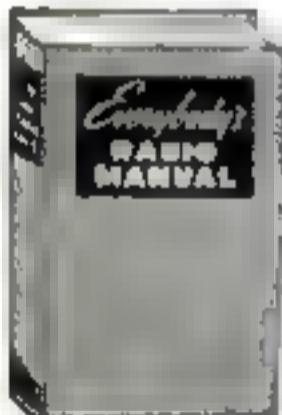
Together these 2 books complete your home library! "Everybody's Radio Manual" gives you vital fundamentals, teaches you how to "trouble-shoot" read blue-prints, stop interference, improve old receivers. "Radio For the Millions" brings you complete wiring diagrams and step-by-step instructions for building 78 radios, phonographs, recorders!

YOURS AT A BARGAIN PRICE!

Two mammoth books like these, crammed with hundreds of pictures, diagrams, tables, codes, definitions and plans should sell for at least \$3.00 apiece—but you can have both for the bargain price of only \$2.98! Why, the money saved on your first repair job more than pays for the books!

READ THEM 7 DAYS FREE!

Order this great set at once before it's sold out! Send no money now—just fill in and mail coupon below. Pay postman only \$2.98 plus a few cents postage, when he delivers your books. (Or you can order either book alone if you wish). Let these giant books prove for themselves what wonders they can do for you! You take no risk. If after 1 week's free trial you aren't delighted, return books for full refund.



EVERYBODY'S RADIO MANUAL

300 PAGES!
10 BIG CHAPTERS!
216 PICTURES!
75 WIRING DIAGRAMS!

Only \$1.49 in Deluxe Binding

This clear-cut, simply written manual is jam-packed with step-by-step instructions for building and repairing all types of radios! It shows how to solder, cut and drill, how to read radio wiring diagrams, check circuits, make testing instruments, measure capacities, identify high voltages, calculate resistances, and locate open circuits. Read the big chapter on improving old radios, wiring battery sets for AC current, adding phonograph attachments, and adapting sets for short wave reception. You'll find complete plans for building 11 sets including an AC-DC short wave receiver, a simple wireless record player, and a 3-way portable! It's just bursting with short-cuts, pictures, diagrams. Order now while stocks are still available!

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For both

HERE'S WHAT YOU GET IN THIS "2-VOLUME REFERENCE LIBRARY":

448 PAGES—PLANS FOR 89 SETS
864 PICTURES—150 DIAGRAMS
HUNDREDS OF HOME RADIO REPAIRS



RADIO FOR THE MILLIONS

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- Television antennae
- Around-world receiver
- Cabinet ideas
- Vest-pocket receiver
- Book-end radio
- 2-tube receiver
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353 Fourth Ave., New York 10, N. Y., Dept. 88
Send me the following book(s) checked:

Everybody's Radio Manual, \$1.49 } or \$2.98
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I will pay postman \$1.49 for Everybody's Radio Manual or \$1.98 for Radio For the Millions—or \$2.98 for BOTH (plus postage). If not delighted, I may return books within 7 days for full refund.

NAME _____

ADDRESS _____

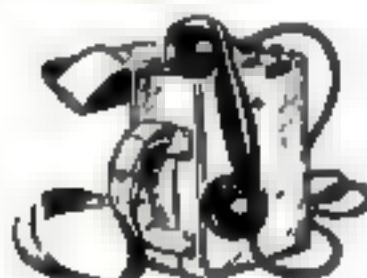
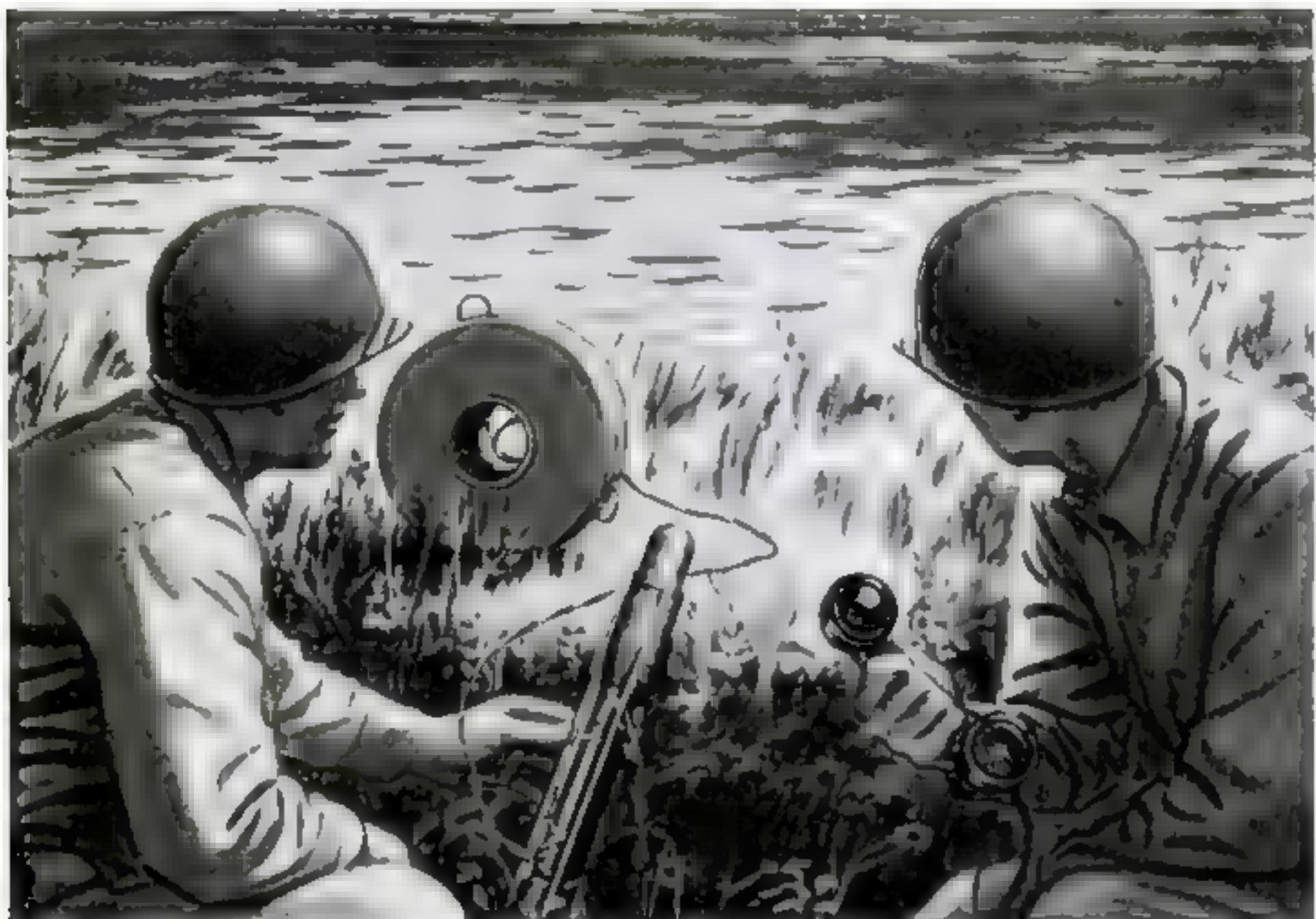
CITY _____ ZONE _____ STATE _____

Check here if you send payment with order, and we will pay all shipping costs. Same return privilege.

This is a black and white page from a vintage catalog or magazine, likely from the mid-20th century. The page is filled with numerous small advertisements for various novelty items and games. At the top left, there's an ad for "Atomic Energy Clocks" with a small illustration of a clock. Next to it is an "AIR PISTOL" advertisement with a large image of a pistol and a price of \$3.49. To the right is a "MIDGET CAMERA" section with a camera illustration and a price of \$1.98. Further down the page, there are ads for a "BUDGET BANK VAULT" (\$1.98), "MOTORSCOOTER PLANS" (\$1.98), and a "LIFE-LIKE REALISTIC RUBBER MASKS" section featuring three mask illustrations. Other items include a "POWERFUL TELESCOPE" (\$1.98), a "2-WAY WRIST RADIO" (\$1.98), a "POCKET SIZE POWER RADIO" (\$1.98), a "RADIO HORSE CHAMPION" (\$1.99), a "NITE BUILDERS" set (\$1.99), a "HANDBYMOBILE" (\$1.99), a "Fencing Set" (\$1.99), a "THROWING KNIFE" (\$1.99), and a "MAGNETIC FIGHTING COCKS" (\$1.99). There are also ads for a "22 CALIBER RIFLE" (\$1.99), a "CANNON" (\$1.99), an "AUTOMATIC PAINT SPRAYER" (\$1.99), a "ROTARY PRINTING PRESS" (\$1.99), a "VACUTEX" (\$1.99), a "POP-UP THEATRE" (\$1.99), and a "LUMINOUS PAINT" (\$1.99). Other items shown include a "BATTERY ELECTRIC SPEED BOAT" (\$1.99), a "LIVE CHAMELEON" (\$1.99), a "CHRONOGRAPH STYLE STOP WATCH" (\$1.99), a "MOTORCYCLE" (\$1.99), a "TURBINE STEAM ENGINE" (\$1.99), a "ELECTRIC SHOCKER" (\$1.99), a "GAS VENDING MACHINE" (\$1.99), a "2-PASSENGER MIDGET RACER PLANE" (\$1.99), a "MOTORSCOOTER" (\$1.99), a "BICYCLE" (\$1.99), a "SKULL RING" (\$1.99), and a "BUDGET BANK VAULT" (\$1.99). The page is packed with dense text and small illustrations, typical of mid-century commercial printing.

**SEND ORDERS FOR
ARTICLES ON THIS PAGE TO**

Johnson Smith Co., Dept.C-18,Detroit 7, Michigan



WHERE WILL YOU HAVE YOUR TELEPHONE?

JUST point out the spot. The U.S. Army can lay a telephone wire at your feet before you can say "Rocket!"

And that's just what you would say, because the modern soldier can use rockets to carry field telephone wire over any kind of terrain up to 150 yards.

Treacherous rivers, cliffs, mountains — even terrain swept by shellfire — none of these is a major obstacle any more. The rockets carry the wire up and over and put it down where you want it!

An improved wire dispenser, tested and proved by the Signal Corps, makes possible this unique method of establishing quick communications under diffi-

cult conditions. It's only one of scores of new developments, new methods, new equipment which the Regular Army soldier works with every day.

As a soldier today, you deal in "futures." You're out in front, with new techniques, new equipment, new developments in science and industry. You do things better and faster than any other soldier because you get the finest kind of equipment to go with your native "know-how."

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U. S. ARMY AND U. S. AIR FORCE
RECRUITING SERVICE





The Voice of Science

Machinist or Scientist?

CAN you tell by looking at this man whether he is a machinist or a scientist? Whatever you say, you will be right—because this man is both!

He went to work for General Electric back in '22 as a drill-press operator. His first job in the Research Lab was as a machinist. In '31, Dr. Irving Langmuir picked him for an experimental program and he began to function as a scientist. Night study (he had only two years of high school) made him a research chemist. He is best known as the "snowflake scientist" because he developed the method of capturing crystals in plastic.

And because, with Dr. Langmuir, he made it snow indoors and out by seeding clouds.

Know him now? Of course you do: Schaefer is the name. People have been calling him "Doctor Schaefer" for some time. Last June, Notre Dame made it legal.

You can see that Vincent J. Schaefer, D. Sc., and Mister Schaefer, first class machinist, are of one and the same mind in believing that the scientist and the good workman have much in common.

Perry Githens



Great drama comes to television in NBC telecasts of Theatre Guild presentations.

How wide is "Broadway"?

To people all over the world "Broadway" means the theatre. So when NBC, in October, 1947, introduced regular telecast performances of Theatre Guild productions, an expansion of "Broadway" began—and some day it will be nation-wide.

Today, if you live in a television area almost anywhere from Boston to Richmond, the new "Broadway" of television runs past your door.

Now you can see great plays, professionally performed by noted actors. That's news, exciting news, to lovers of the theatre.

Celebrated artists run through lines and action before keen-eyed RCA Image Orthicon television cameras. At your end of the picture, on an RCA Victor home television receiver, action is sharp, clear, detailed...and voices flawless.

That television can make so important a contribution to American entertainment is in good part the result of pioneering and research at RCA Laboratories. Such research enters every instrument bearing the name RCA or RCA Victor.

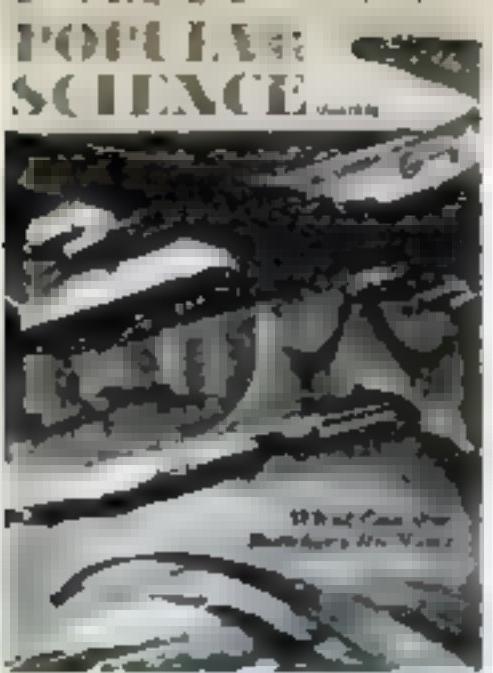
When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 38 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.



RADIO CORPORATION of AMERICA



Light Stopped . . . This picture—uninteresting at first glance—is one of the most important photographs ever taken—the first published portrait of a ray of light stopped in its tracks. Each white dot is the reflection of the same beam of light in one of a series of mirrors spaced along an inclined board (inset). The lower dot is about 10 feet from the camera, the upper one, 20 feet. The 10 feet between them is the distance the light—going a billion feet a second—traveled during the time the shutter was open—1/100,000,000 of a second. This world's record wink was attained by Navy scientists at Pasadena, Calif., with a Kerr-cell shutter (PS, July '48, p. 136) attached to a Kodak 35 mm.



What Can Our



Boss of the big bombers, Gen. George C. Kenney heads the Strategic Air Command. A veteran of the Pacific air war, he is an old hand at the business of long-range heavy bombardment.

Bombers Do Now?

America's foremost authority on strategic air power tells how amazingly bombing has changed since World War II.

IT TOOK the United States and its allies a long time to bomb the will and ability to fight out of Germany and Japan. Tens of thousands of planes and advanced bases all over the world were needed.

You'll never see anything like that again. A few hundred planes will suffice the next time. They will make fewer raids, taking off from fields in Texas, New Mexico, North Dakota, and Washington, rather than from bases in England and the Marianas.

They will fly farther, but they will not tote so many tons of bombs. One reason is that the atom bomb knocks out whatever it hits for keeps. Another is that there won't be time enough for island hopping and base building.

These are the views of America's leading authority on this subject, Gen. George C. Kenney, head of the Strategic Air Command. He is a tough little man with a brush haircut and a square, leather-wrinkled face. He has been in the long-range bombardment business a long time. He fought for air power with Gen. "Billy" Mitchell back in the lean days. He sold General MacArthur on air power and, by his use of it, he undoubtedly shortened the war in the Pacific.

Two world globes flanked his desk when I interviewed him recently at Andrews Field, Md. One of them is calibrated to give global distances at a glance—from anywhere in the United States to anywhere anywhere. The other, a larger model, reminded me of one I had seen in his office in Brisbane,

*An interview with General Kenney
By Herbert Johansen*



Taking a B-29 out of moth balls

Australia, in 1944. Then as now Kenney made frequent trips to the globe, drawing a line with his finger to stress a point.

It's Kenney's job to be ready for whatever might come. "Never again," he declared, "will we bat down one war factory after another, one industry after another, utilities, communications, and so on." Grim as the prospect is, we would, on provocation, send our atom-armed

bombers for a blanket attack on the enemy's centers of industry and population, stunning him, paralyzing him.

"That's what an enemy would do," Kenney is convinced. "If we are attacked, it won't be with just one bomb. It will be a slug-'em-out attack . . . A study of wars throughout history has taught us the brutal fact that, regardless of other factors, a decimation of population means almost certain defeat. Any enemy who might attack us knows that. And that's why we've got to be ready to bat back with a more powerful blow—shoot 'em on the rise."

"If we don't, we won't be standing in lines to buy nylons. We'll be standing in lines to live—if there are doctors and nurses left to jab our shriveled arms with an injection of some antidote for radioactivity that we haven't yet discovered."

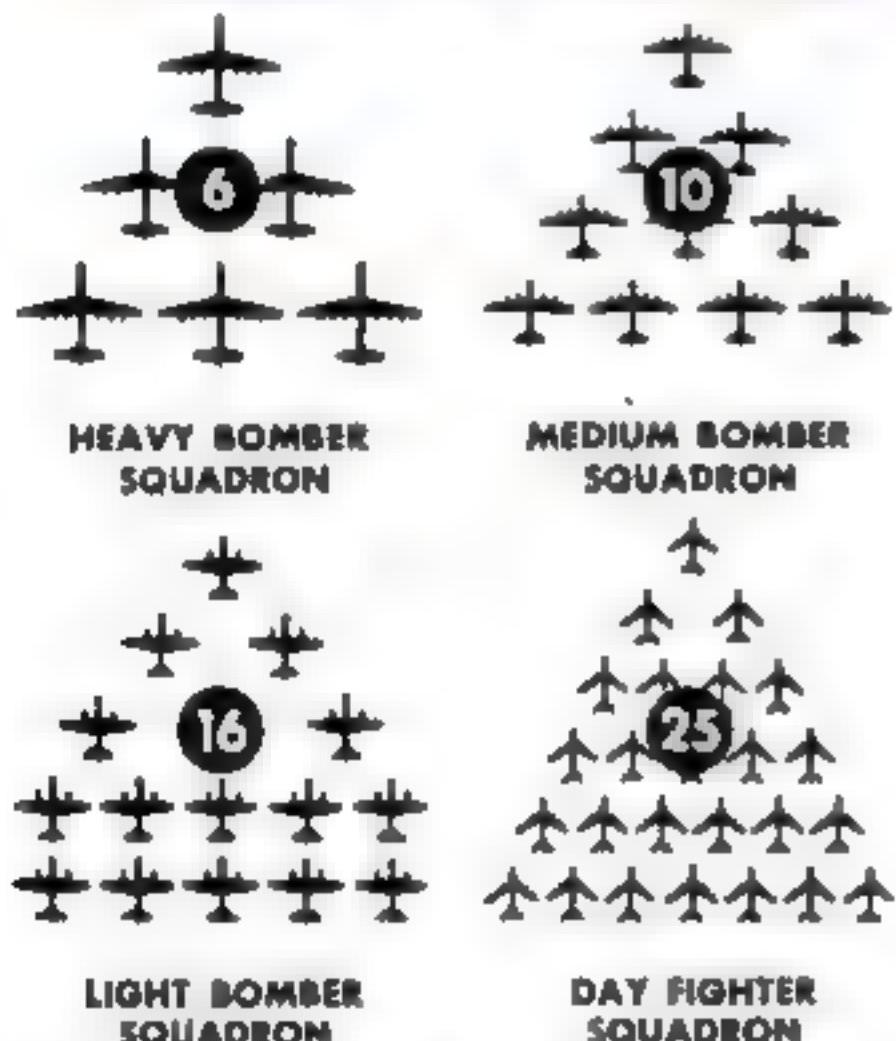
Strategic bombardment in World War II depended on how far we could go and still carry a profitable bomb load. But today, strategic bombing authorities are concerned with only one bomb load—the atom bomb.

The atomic bomb gives a single plane the



The new Superfortress, Boeing's B-50, looks like its predecessor, the B-29, but has more

power and range. For concentration of fire-power, one man can control all five gun turrets



In the new Air Force, three squadrons of the strengths shown above compose a group. In World War II, a heavy bomber group had 48 planes; for the atomic age, this has been reduced to 18. Under the 70-group Air Force set-up there will be 21 heavy bomber groups, 5 light bomber groups, 22 fighter groups, 3 all-weather fighter groups, 4 tactical reconnaissance groups, 5 long range reconnaissance groups, 10 troop-carrier groups, plus 22 separate squadrons such as liaison and rescue. Aircraft required: 6,869. Besides these, there will be 27 National Guard groups and 84 Air Reserve groups.

destructive power of 1,000 planes loaded with old-fashioned bombs. So even the 70-group Air Force you've been reading about in the newspapers will have only about 700 very heavy bombers, as compared with 14,000 used by the U. S. Army Air Forces and the RAF in the European Theater alone.

Right now, we have a lumber with greater range than any plane has yet flown in combat-ready to take off in a matter of hours. It isn't a new 20,000-, 15,000-, or even 10,000-mile bomber. It has neither jets nor rockets. It's the B-29 that delivered the A bomb to Nagasaki and Hiroshima.

"Nothing new has been added to this longer-range B-29," General Kenney explained, "except more efficient flying, squeezing every mile out of its engines and fuel load—a system of flying called cruise control."

Bombing America's most probable enemy with B-29s would entail one-way flights, but the airmen would figure on landing in friendly or neutral territory. We have several thousand B-29s in mothballs—possibly enough for 10 months of war.

We have other bombers with greater built-in range than the B-29, but they are not yet in mass production. Such a plane is the B-50. It looks like the B-29, but inside design changes and improved performance make it a 75 percent new plane. Its top

speed is around the 400-m.p.h. mark. The B-50's range, with cruise control, will undoubtedly exceed 6,000 miles—but just how much remains to be seen. Supercharger trouble and a few other "bugs" remain to be ironed out.

Another long ranger is Consolidated-Vultee's giant B-36. It has flown 8,000 miles with a dummy bomb load of about five tons. That flight was equivalent to a round trip between Alaska and Moscow. Kenney believes that its full gross load can be increased another 25 tons. That would make it a 10,000-mile bomber. But the 139-ton weight of the B-36 doesn't exactly fit in with his plans.

When asked about a 15,000- or 25,000-mile bomber, Kenney said he didn't want it. He considers the B-36 the last of the



Biggest of the bombers, the B-36 was designed to carry five tons of bombs for 10,000 miles.

big reciprocating-engine, propeller-driven bombers. He doesn't want more range if it means making planes bigger and heavier.

"Propellered aircraft undoubtedly could be developed to give a range of 25,000 miles," he pointed out, "but with increased range, the speed, in relation to jet jobs, decreases to a point where the bomber would be a sitting duck for jet fighters or antiaircraft fire. Rather than sacrifice the advantage of speed, I would add the extra range I need by refueling in flight."

He is convinced that in-flight refueling of combat planes is a certainty. So his ideal bomber would have a range of about 7,000 miles built in, and a speed of between 500 and 600 miles per hour. It would be either a turboprop or jet-powered job.

High-efficiency turbojets and ram-jets can give speeds way up in the supersonic regions, but at present range is limited. General Kenney, while discussing the problem, picked up a model of the sweptback-wing Boeing XB-47 six-engine jet bomber.

"This, or something like it," he said, "may be the answer to speed and range."

The XB-47 can do around 600 m.p.h. and, although still experimental, has a range reported to be around 3,000 miles.

The Lockheed-designed XJ-37 turbojet engine (PS, June '48, p. 144) may solve the problem, licking the high fuel consumption of other engines of this type. Its high thermal efficiency may give jet bombers the long range of their reciprocating-engine brothers.

Another solution may be nuclear energy for fuel. But however we get it, long range will be as essential to the next air war as the atomic bomb. Outlying bases, such as Stephenville, Newfoundland, or Mile 26, near Fairbanks, Alaska, will be no more than fighter-protected fuel dumps. A quick landing there to load up with gas, and then on across the North Pole—to come back or not, depending on range available at the time.

The atom bombs will be kept in the safest places as long as possible. So our very heavy, long-range bombers will take off from bases in the heart of the United States. Right now, Strategic Air Command headquarters is being moved from Andrews Field, Maryland, to Offutt Field, Nebraska.

General Kenney's boys have dreamed up an ingenious way of greatly increasing the amount of auxiliary gas that can be carried economically—but he'd rather not talk about it right now. So that leaves cruise control and in-flight refueling (PS, Jan. '47, p. 82).

The father of cruise control is Col. C. S. "Bill" Irvine of *Pacific Dreamboat* fame (PS, Dec. '46, p. 91). The trick is to make



The XB-47 has 6 jet engines, 4 in pairs and one near each wing tip. It can carry the A bomb.

each part of the engines carry its full share of the load, to make it work evenly, smoothly, and at top efficiency. During the war, "engine flying" increased the bomb load from three and a half tons to 10 tons.

Ways to do it still better have been found since then. Even the best tuned-up carburetor system, for example, is inefficient because of its uneven distribution of fuel. The answer was fuel injection, which gives each cylinder exactly the same amount of gas.

Today there is no guesswork in flying the B-29, and there won't be in flying the B-50. As the flight engineer watches electronic fuel gauges, flow meters, and other instru-

ments, he knows exactly what is going on in the engines, whose spark-plug gaps have been adjusted to 1/10,000 inch. Torque meters tell the exact horsepower each engine is pulling. If there is the slightest deviation from the flight cruise plan, a correction is made. With no margin of error allowed, the word precision has the same meaning in cruise-control flying that it has in the laboratory of a microchemist.

The other main factor in mile stretching is mid-air refueling. It is one of Kenney's top-priority projects. The British have operated aerial gas stations over both the South and North Atlantic, using a B-24 as the tanker and a Lancaster cargo plane as the receiver. And as this article was being written, a simplified version of the British equipment was being tested over the North Atlantic at altitudes above 12,000 feet, with contact between the planes made by radar.

Since the B-29 is pressurized and the air is extremely cold at high altitudes, manual adjustments outside the plane are impossible. So the system has to be fully automatic. The two planes fly about 100 feet apart, and gas is transferred at a rate of about 100 gallons a minute. Because the planes have to operate as Siamese twins, Kenney plans to use two of the same type: that is, a B-29 tanker would fuel a B-29 bomber.

Where would we refuel our bombers? General Kenney walked over to one of the two globes and pointed to the tip of the always-on-top northern hemisphere.

"If we get into trouble again," he said, "the attack will probably come over the shortest air routes from the European-Asiatic land mass across the North Polar basin. And that's where I'd refuel—right over the North Polar basin, north of the Arctic Circle."

Fighter escort for long-range strategic bombing missions is a moot question. There is no fighter today that has enough range. An escort plane with a radius of even 5,000 miles would carry turreted armament. To protect the bomber, and itself, it would remain in formation, firing on any attackers that came within range. Such a fighter would have to be almost as big as the bomber it defended.

Then there is the kangaroo approach, with the bombers carrying their own fighter escort. Already under test is the McDonnell XP-85 parasite fighter, designed to be nestled inside the bomb bay of the giant B-36. It would be released in case of attack and picked up later. But General Kenney isn't too keen about the idea. "I'd use the added weight for gas," he said.

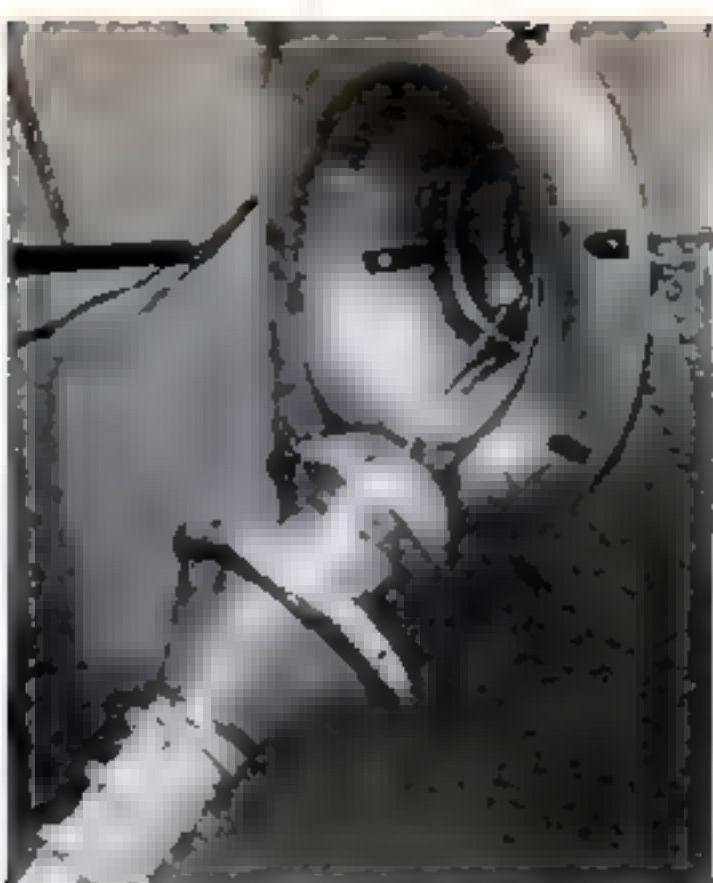
There'll be no fighter escort in his book. Bombs will be dropped from 25,000 to 30,000 feet under cover of night or through clouds. The greater speed of jet bombers may make daylight bombing feasible. Those who shake their heads and point to the heavy losses of unescorted bombers in World War II might mull over a recent report that 10 of our continent-based B-29s made a mock attack on England. Of the 10 bomb-



One atom bomb, with the destructive power of 10,000 tons of TNT, did this on August 9, 1945, to Nagasaki, a city of more than 200,000.



A mass formation of bombers using ordinary bombs was needed to do this to a single Nazi factory. The photo shows 286 bomb craters.



Refueling in flight is the gimmick that will give extreme long range to our bombers. Above, right, is shown a photo of a British B-24 refueling a Lancaster. The detailed photo at



left shows how the leader line caught by the receiver plane pulls in the fuel hose. U.S. method is a simplified version of this system, adapted for high-speed, high-altitude bombers.



Long, 10,000-plus-foot concrete runways will not be necessary with the track-gear shown



above. Pictured at right above is the gear installed on a 54,000-lb. Fairchild C-82 Packet.

ers, six were detected, but only two of the six were "shot down" by RAF jet fighters. In experiments conducted by our First Fighter Group, P-80 jet fighters have encountered difficulties in making interception attacks on individual B-29s coming over at extremely high altitudes.

If we send our bombers out on serious business again, they will not go in mass formations to make a meaty target for interceptors. We would probably not assign more than six bombers to a target, and they would make the bomb run from different directions.

There may be few places in friendly territory where the heavyweights can land the way they would at home. But Kenney says we may not need such bases. "We may use track-type landing gear," he explains.

Fairchild has been experimenting with this idea for some time, using a gear made

by Firestone. Tractor landing gear was recently installed and successfully tried on a C-82 Packet. It is in the works for the B-29, the B-50, and even the B-36.

With this gear, which on very large aircraft saves weight, our biggest bombers will be able to take off and land from almost any reasonably flat area: prairie, desert, tundra, beach, snowfield. Kenney points out that even ice caps could become emergency bases if we sent a glider in with a bulldozer to smooth out the hummocks.

"We've got to have this and a lot more," Kenney emphasized. "Equality with any enemy isn't enough. If we let the other guy get ahead of us, he'll drop something else along with the pay-off A bomb—it will be a fountain pen for us to sign the dictated terms of bondage."

END

For a pictorial summary of strategic bombing, turn to the next page.

BASIC RANGE — 3,200 MI.



Boeing's Superfortress plus the atom bomb is our weapon of long-range bombardment today; if trouble should come, we have a reserve of 2,000 Superforts in storage.

WITH CRUISE CONTROL — 5,700 MI.

REFUELING TWICE IN FLIGHT — 10,260 MI.

BASIC RANGE — 5,000 MI.



At first glance it takes an expert to tell the B-50 from the B-29. The 50's tail is six feet higher, and wing area is 25 square feet greater. Engines have 3,500 hp.

WITH CRUISE CONTROL — 6,500 MI.

REFUELING TWICE IN FLIGHT — 11,700 MI.

BASIC RANGE — 8,300 MI.



Consolidated-Vultee's huge bomber has six pusher props.

WITH ADDED FUEL — 10,000 MI.

REFUELING TWICE IN FLIGHT — 18,000 MI.

BASIC RANGE — 3,000 MI.



It is still too early to tell what the jet entry for long-range bombardment will be. General Kenney likes the sweep-back, six engine Boeing Stratojet.

MORE EFFICIENT JET ENGINE —

NUCLEAR FUEL —

How Far Can Our Bombers Go?

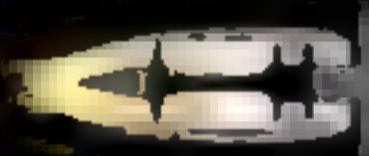
THE B-29 Superfortress, a veteran of the last war, is still the best we have today; it now has a range close to 6,000 miles. Bombers with greater range, like the B-50 and the B-36, are flying, but are not in mass production. Both are still being improved as "bugs" are eliminated. Under pressure of war, they could go into immediate production. And, like the B-29 in World War II, they could be flown from assembly line to front line, getting their service tests in actual combat. Cruise control — more efficient flying — already has almost doubled bomber range, and in-flight refueling will probably make it unnecessary to build bigger and heavier bombardment planes to gain greater range. The non-stop, globe-girdling bomber died on the drawing board.

Engines vs. Distance

1,000 miles
2,000 miles
3,000 miles
4,000 miles
5,000 miles



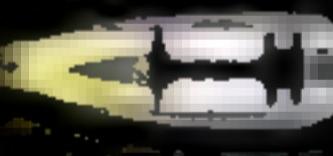
COMPOUND-
RECIPROCATING:
20,000 miles.



TURBOPROP:
5,000-10,000 miles
at high speeds.



REC/PROPELLER:
5,000-10,000 miles
at medium speeds.



TURBOJET:
1,000-5,000 miles.



RAMJET:
Up to 1,000 miles.

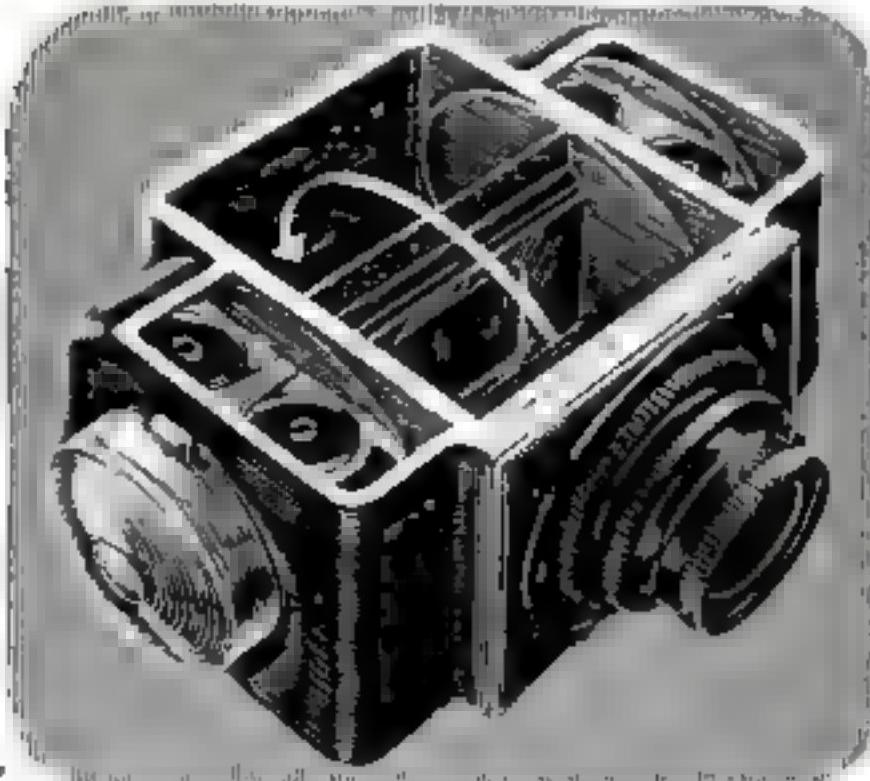
The above range figures are approximations, but give an idea of the relative scope of operation of current and future aircraft powerplants. Jet fighter aircraft make it imperative that speed be built into our big bombers. Fuel economy — for range — therefore cannot be bought by too great a sacrifice of speed. Instead, range must be increased in other ways, such as by refueling in flight or by developing nuclear fuel.

New Ideas from the Inventors



Jack Aids Blowouts, Skids. A small wheel in the bottom of this built-in, hydraulic auto jack is designed to act as a temporary support when a blowout occurs. When the jack is lowered further, the wheel

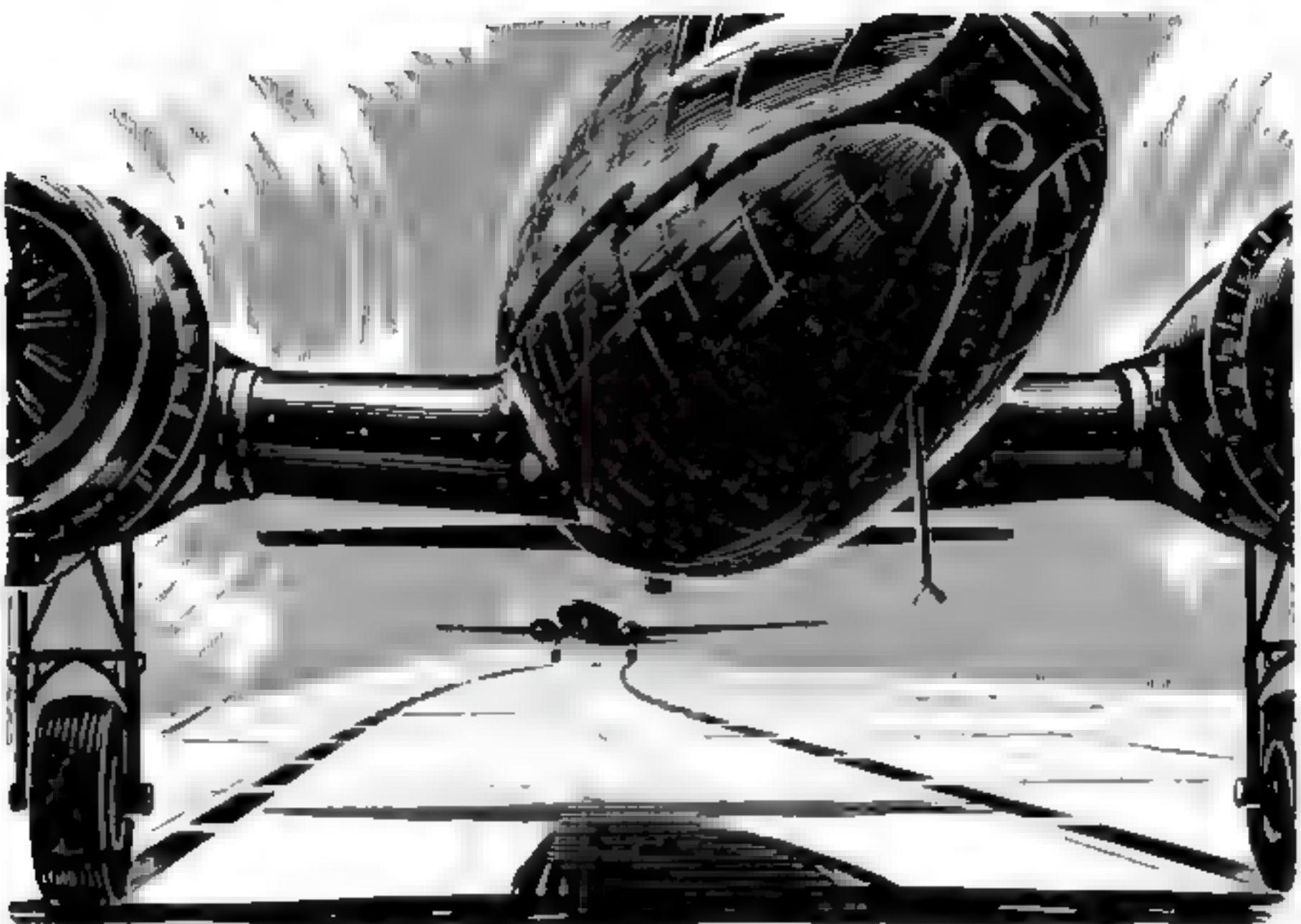
recesses into the base, and the car is raised for easy tire-changing. A spiked plate on the bottom permits emergency use of the jack to stop skidding on ice. A. M. Sorrentino, of Brooklyn, N. Y., is the inventor.



Camera Holds Two Films. With this camera, you'd be able to take color or black-and-white pictures without stopping to change the film. Patented by W. D. Teague, of New York City, it holds two rolls of film back to back with a partition between. A knob on the side rotates the film holders to bring either film in front of lens.

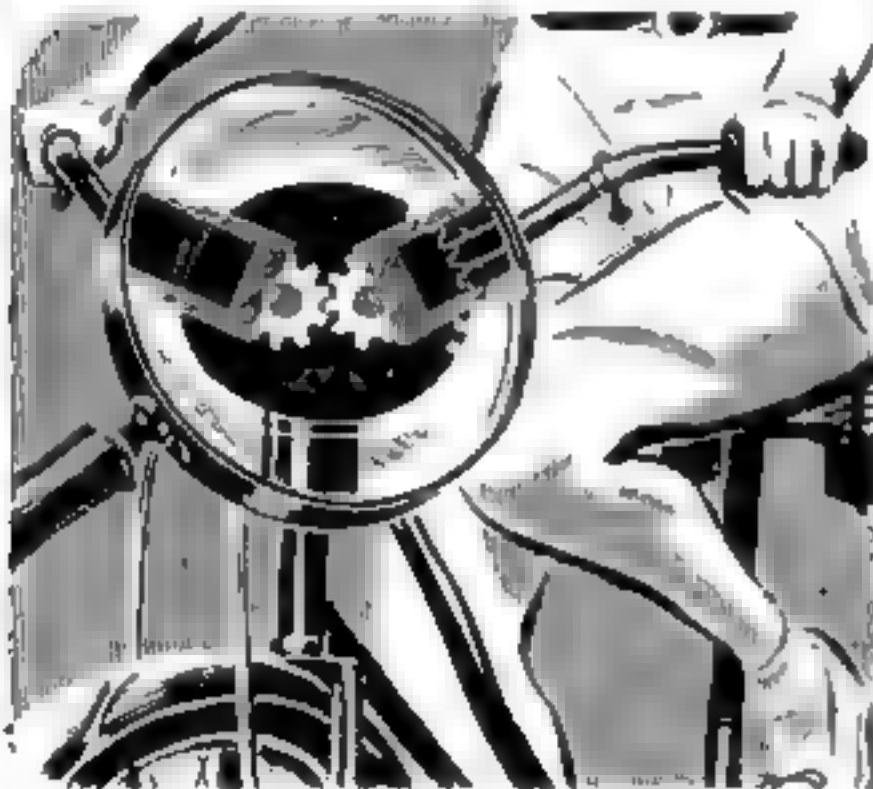


Twister Joins Wire. To save wear and tear on the fingers, W. B. Mitchell, of Seattle, has patented a twister for joining two ends of wire. One wire is threaded through guides on the twister, while the second is hooked under a flange at one end. When the twister is turned, the flange winds the second wire around the first.



Brakes Straighten Plane. Newly patented auxiliary wheel brakes are designed to keep a plane from ground looping if it comes in for a landing at an angle to the runway. As the plane turns, sidethrust

against the wheel on the outside of the turn forces it inward against a brake drum. This pivots the airplane on the braked wheel, bringing it back in a straight line. The inventor is H. L. McPherson, of Memphis.



Handle Bars Are Adjustable. By just tripping a finger release, a bicyclist could adjust these handle bars to the most efficient position for various speeds and terrain. Patented by M. Dufaux, of Geneva, Switz., they are meshed at the steering post by two gears, so each moves with the other. Once set, they lock at desired position.



Shaker Keeps Salt Dry. A ball valve in this novel salt shaker, invented by T. R. Duncan, of North Hollywood, seals it against moisture. The ball rests loosely over a funnel-shaped opening in the bottom and keeps it closed when the shaker is not in use. Shaking the container jiggles the ball, letting out a little salt with each shake.

Iron Horse Trims Its Own Hoofs

MOTORISTS aren't the only ones to worry about flat tires. Locomotives get them too. Their great driving wheels scream against the rails in starting, braking, and grinding around curves until flat spots develop.

That's why railroad men are interested in this new method of shaving them smooth again. It takes only half a day for what once was a five-day job in the shop. The wheels stay right on the locomotive, which itself serves as the lathe to trim them.

The method is called the Lidgerwood system, named for the company that makes the heavy-duty winch used to pull the iron horse while it trims its own hoofs.



Towing cable is looped over pulley mounted on a truck that couples to rear of the tender. When winch turns, locomotive is pulled backward up a special 900-ft. length of track at 1½ m.p.h.



Electric winch, anchored in concrete and powered by 75-hp. motor, reels in 1½-in. cable to tow locomotive along slightly inclined track in the Southern Pacific yards at Los Angeles.



Inch-thick "razors" shave tread and flange of a worn tire to proper contour. They're used one after another (left to right) as winch pulls the locomotive 8 to 14 times along the track.



Cutting head, with slot for "razor," replaces brake shoe. Compressed air holds it against wheel. Tires are trimmed about once a year, after 40,000 to 200,000 miles of service.



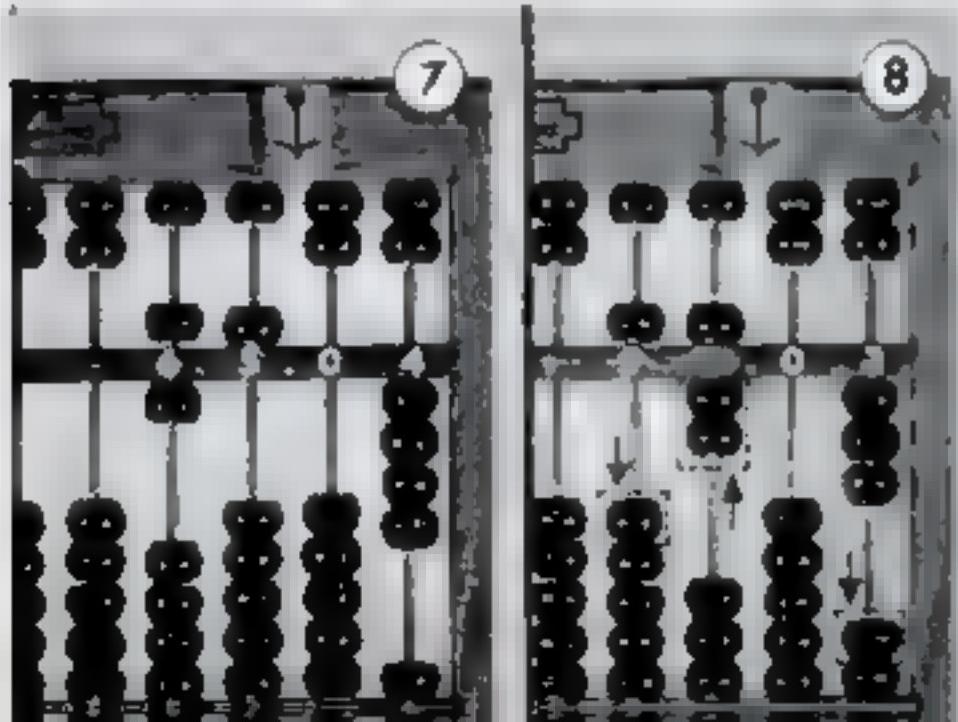
Trimming takes up to a quarter of an inch of steel off tire. After 8 to 11 treatments have cut it from an original thickness of 3½ in. down to 2½ in., the worn tire must be replaced.



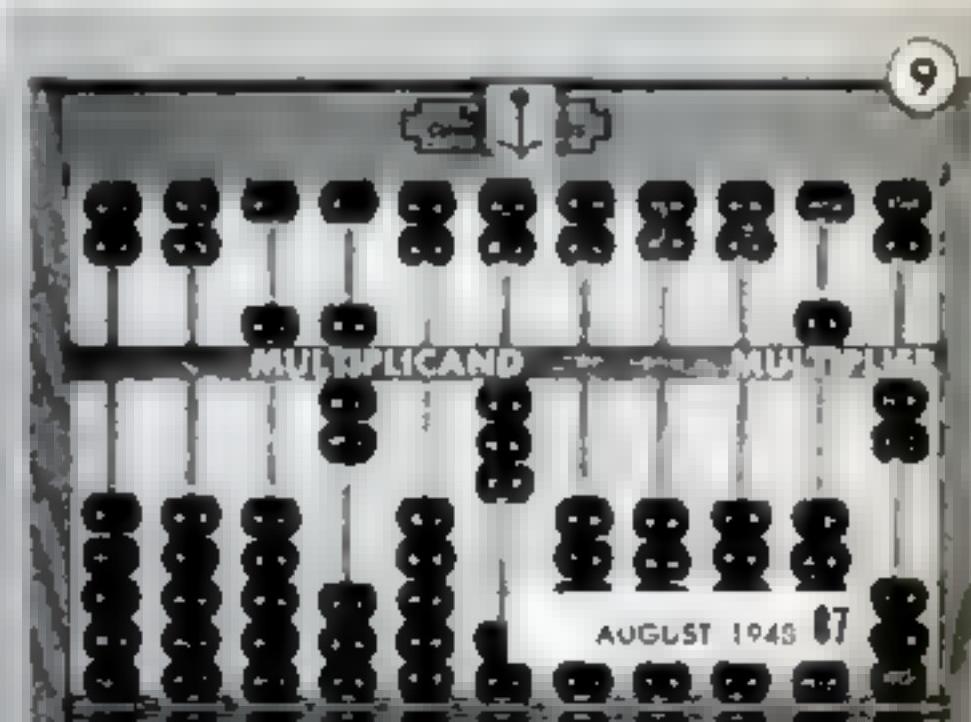
Chinese abacus has five beads below crossbar in each column; two above it. Japanese have one with single row of upper beads; other variations were used by ancient Egyptians, Greeks, and Romans. Author of this article in-

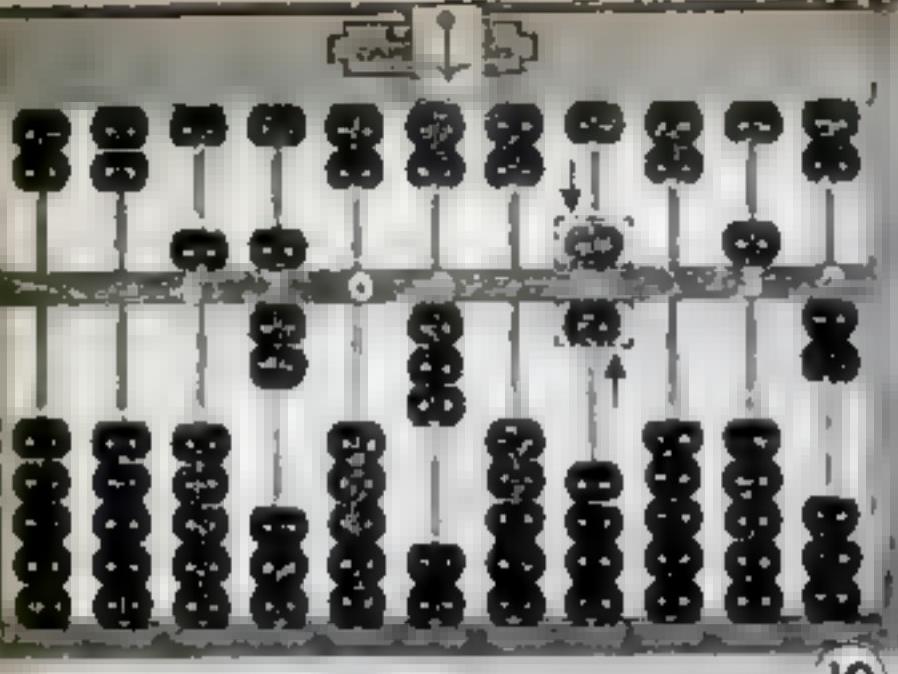
vented sliding pointer to locate decimal point or mark column being used in multiplication or division. This model sells for \$6.50, and can be purchased by mail from him at 1317 Rhode Island Ave., N.E., Washington, D.C.

Subtraction. Now Doe wants to subtract his deductions—\$8.01—from his weekly pay. He clears the abacus, then enters on it Fig. 7 his total pay of \$63.04. Subtraction is literally taking away. To take \$8.01 from \$63.04 he first pulls down one lower bead in right-hand column. Zero from zero is zero; so second column is unchanged. Since he can't take 8 from third column, as only 5 registered, he gets same result by adding two lower beads there and taking away one lower bead representing 100 from fourth column. Answer—\$57.03—shows (Fig. 8) that the company cashier paid John Doe right amount for his week's work.



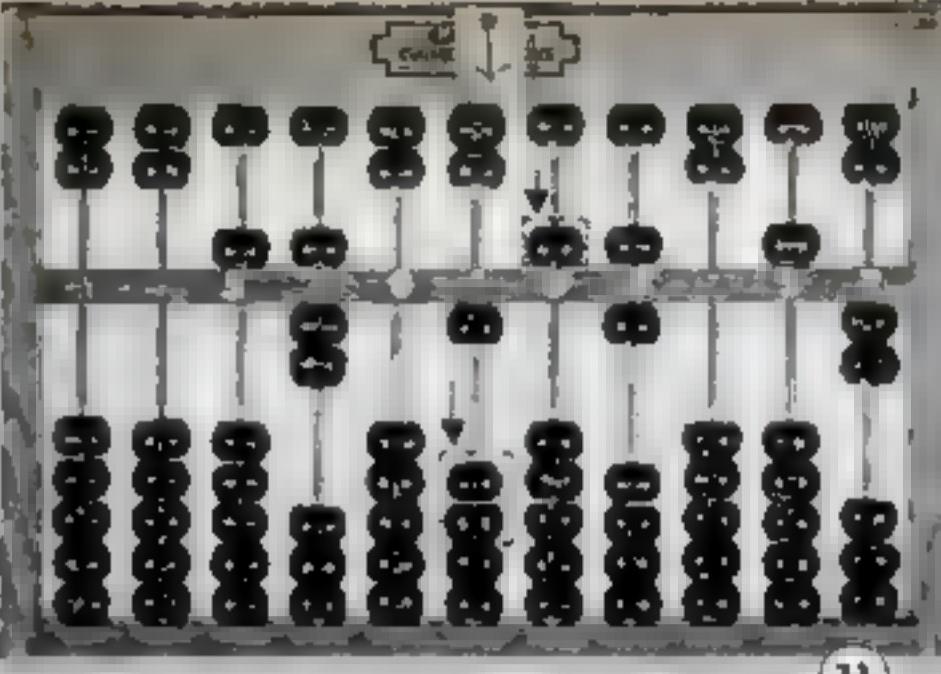
Multiplication. Next Doe wants to find out how much he'll take home in a year if he keeps on earning at this rate. To get that he must multiply \$57.03 his weekly check by 52 weeks in a year. He puts the multiplier 52 on two right-hand columns (Fig. 9, below). The multiplicand, 57.03 goes on any four columns to the left, leaving some space in the middle for figuring. Decimal is disregarded during the calculating and will be inserted later in answer since its position doesn't change in figuring dollars and cents. The sliding arrow no longer needed for decimal, will be used to mark the column on which he is figuring.





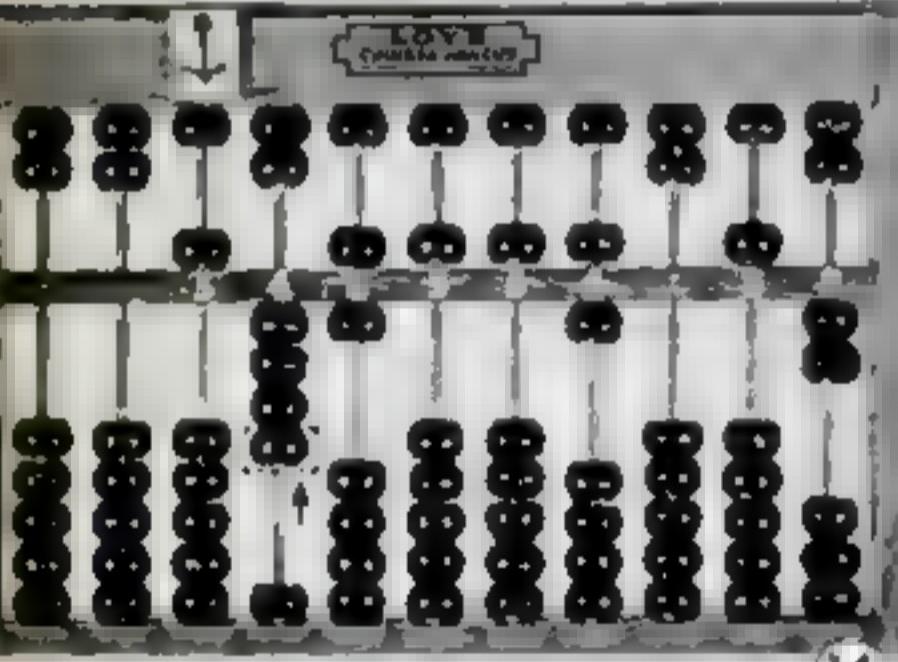
10

Multiplication starts from the right and is based on multiplying single digits, as on paper: $3 \times 2 = 6$. Products of right-hand digit of multiplier go as many columns to right of the digit being multiplied as there are digits in multiplier (52). Doe puts 6 two columns to right of 3.



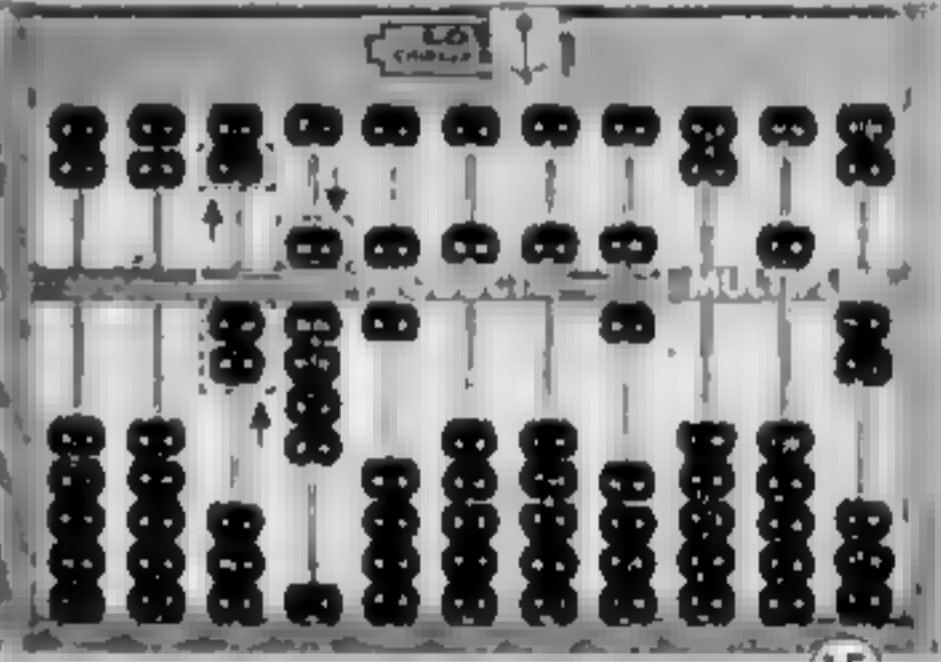
11

Next he multiplies 3 by 5. Since the 5 is one column to left of the 2 in the multiplier, its products go one column farther left. So Doe puts $15 \times 3 \times 5 = 15$ to left of 1 in 6. 3×2 . Because he has now multiplied 3 by both digits of 52 he can get rid of it to make room for the 15.



14

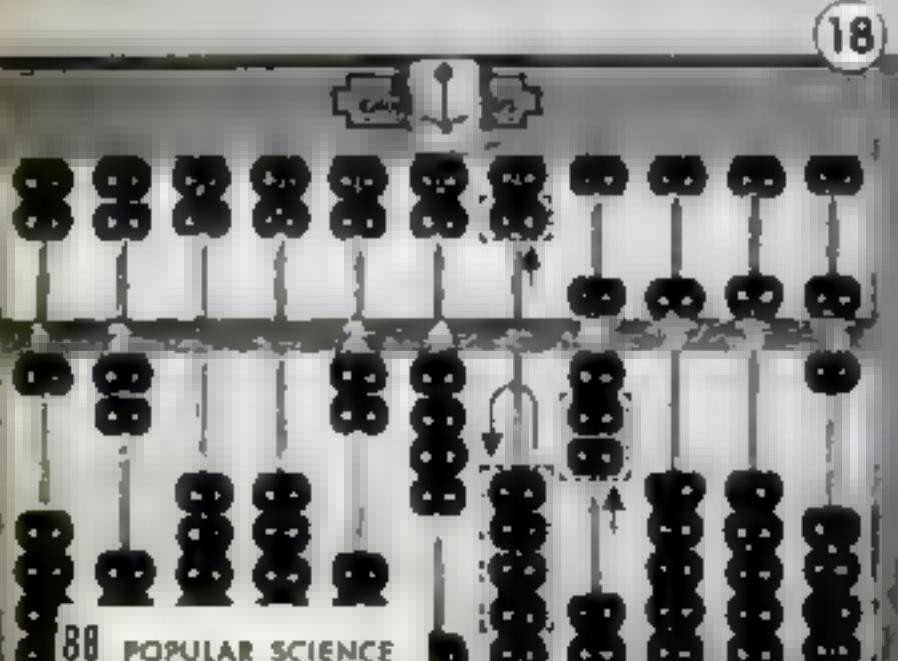
Arrow is moved to indicate that Doe now is working on the 3 column. He multiplies it by the right-hand digit 2 of the multiplier $5 \times 2 = 10$. He adds the 10 again beginning two columns to right of the number being multiplied—5. This he does by adding 0 to that column and 1 in the next column to the left.



15

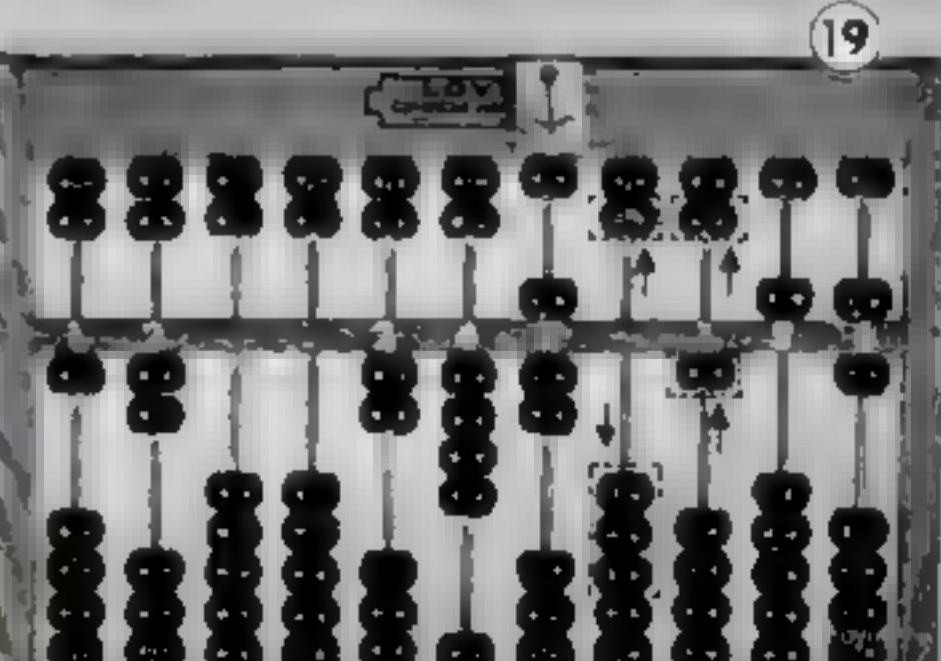
Final step: $5 \times 5 = 25$. As before when multiplying by the 5 product goes only one column to right of the number being multiplied. This finishes multiplication. Doe discards 5 in multiplicand and enters 25 by adding 2 under arrow and 5 to next column to right. Answer, with decimal, is his yearly take-home pay \$2,965.50.

Again (below) Doe divides by 12. It goes four times into 56—now the first two figures of dividend. He enters 4 in quotient, moves arrow over it and subtracts $48 (4 \times 12)$ from 56. He takes the 8 from right-hand column by adding 2 and subtracting 10 (one bead in next column to left). He then takes 4 from left-hand column.

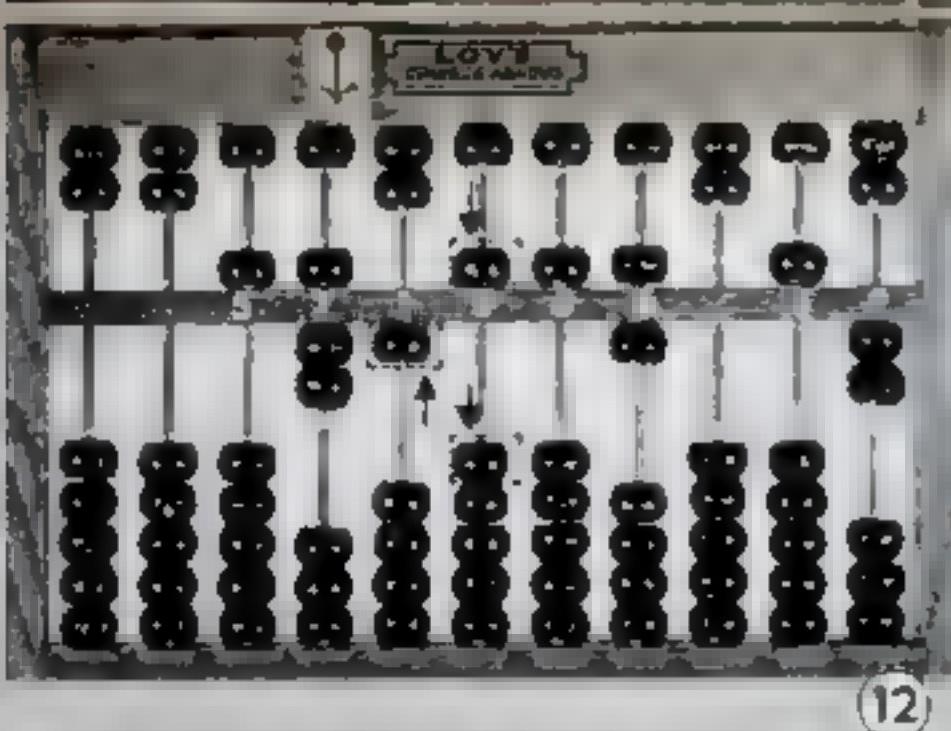


18

Next step in Doe's division goes the same way: 12 into 85, now the first two figures in the dividend. It goes seven times so he enters 7 in the quotient, and moves indicator over it. Then he subtracts $84 (7 \times 12)$ from the 85. This leaves 1. So the three figures now remaining in the dividend as shown below are 156.

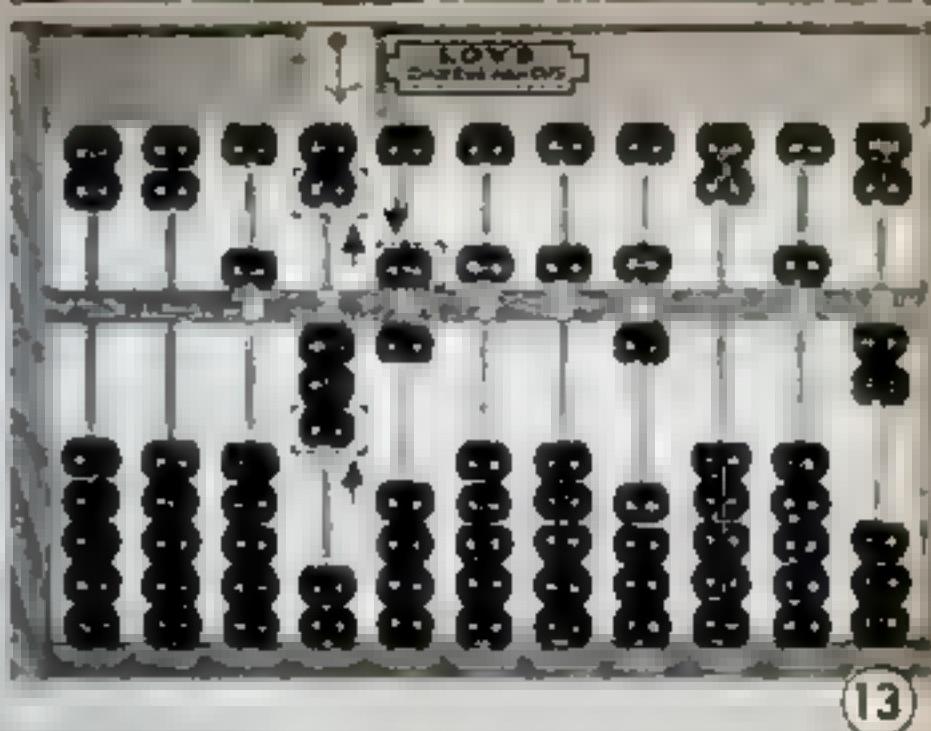


19



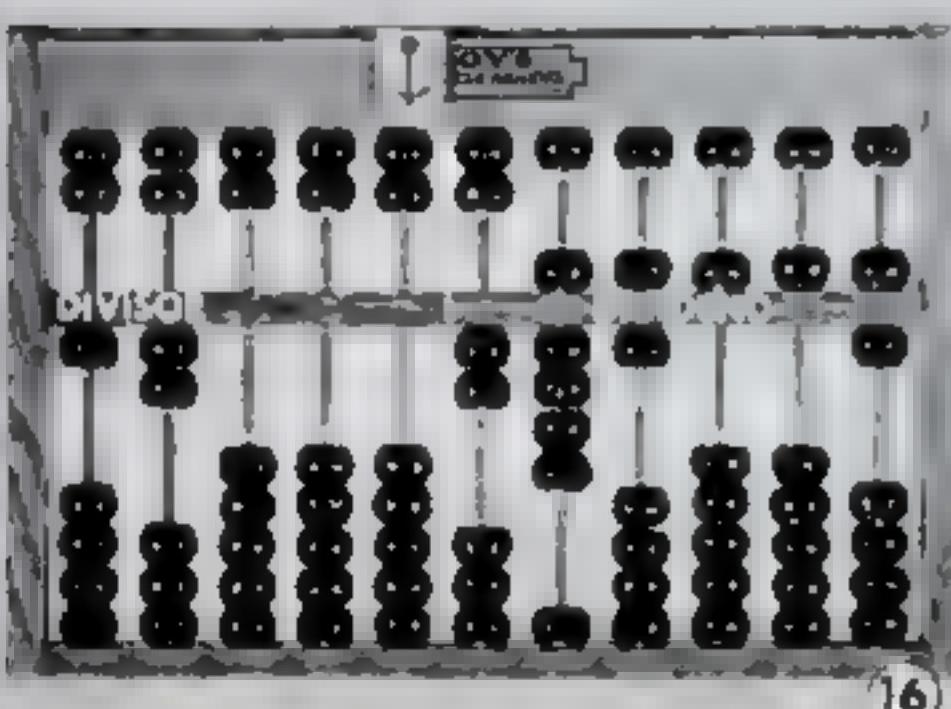
12

Skipping 0 in multiplicand, Doe sets arrow above 7. Again he multiplies: $7 \times 2 = 14$. He puts its answer, as in first step, two columns to right of digit being multiplied -7. This he does by adding 15 (5 in second column to right of 7 + 1 in next column to left) and taking away 1



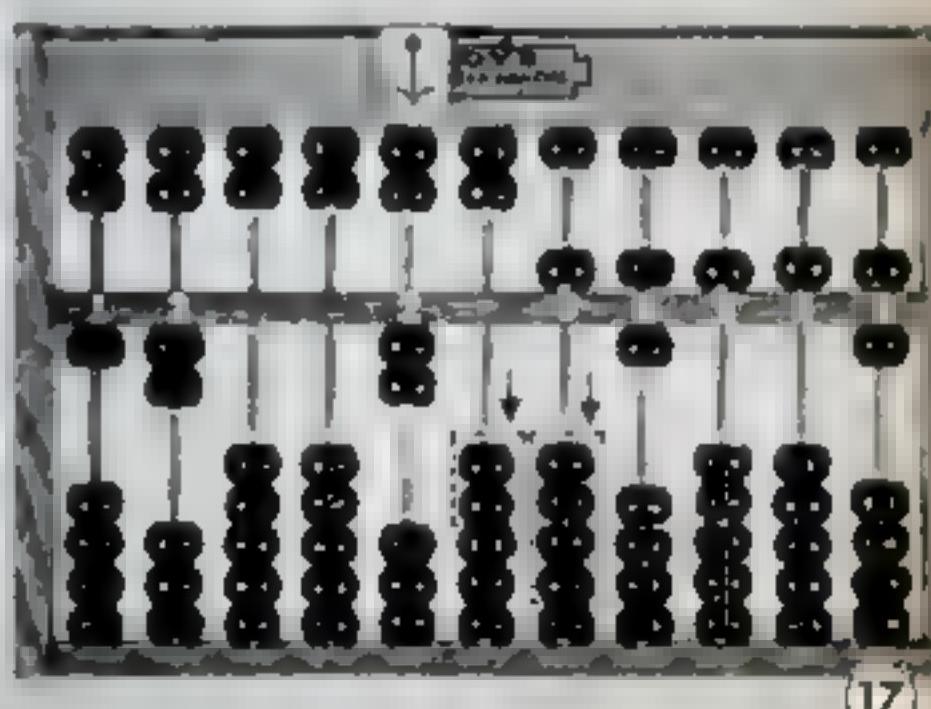
13

He then multiplies 7 by multiplier's left-hand digit (5). Again product (35) goes a column farther left than when he was multiplying 7 by right-hand digit that is, only one column to right of the 7 being multiplied. Finished multiplying 7 he discards it to enter the 35



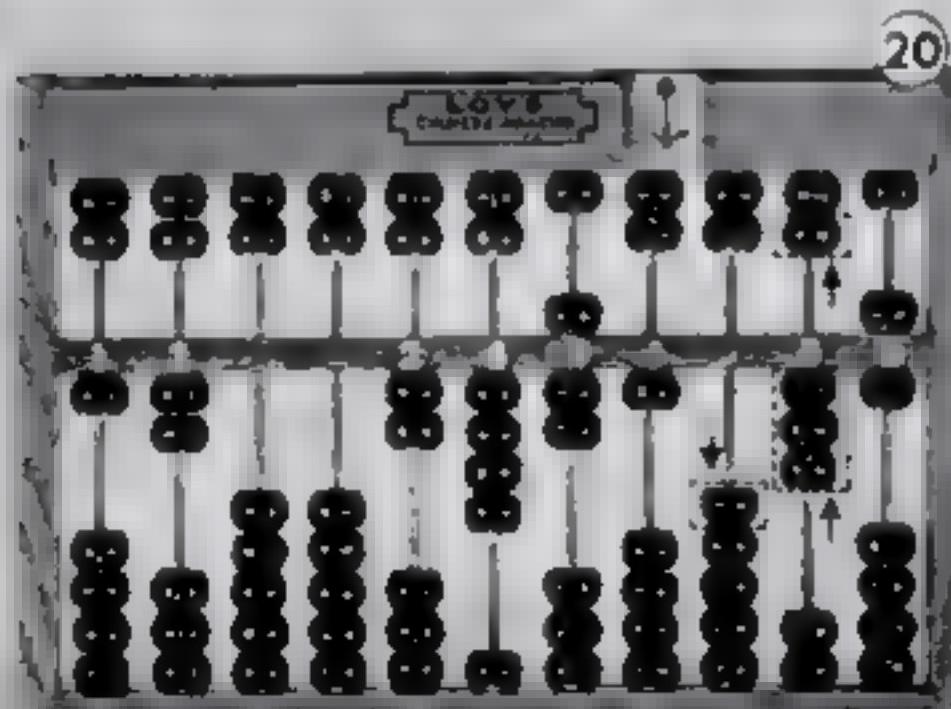
16

Division. John Doe wants to know, next, his average monthly income. To get it, he must divide his yearly total of \$2,965.56 by 12 for the number of months in a year. He first clears the abacus. The divisor, 12, then is placed on the two left-hand columns. The dividend, 296556, goes on the six right-hand columns



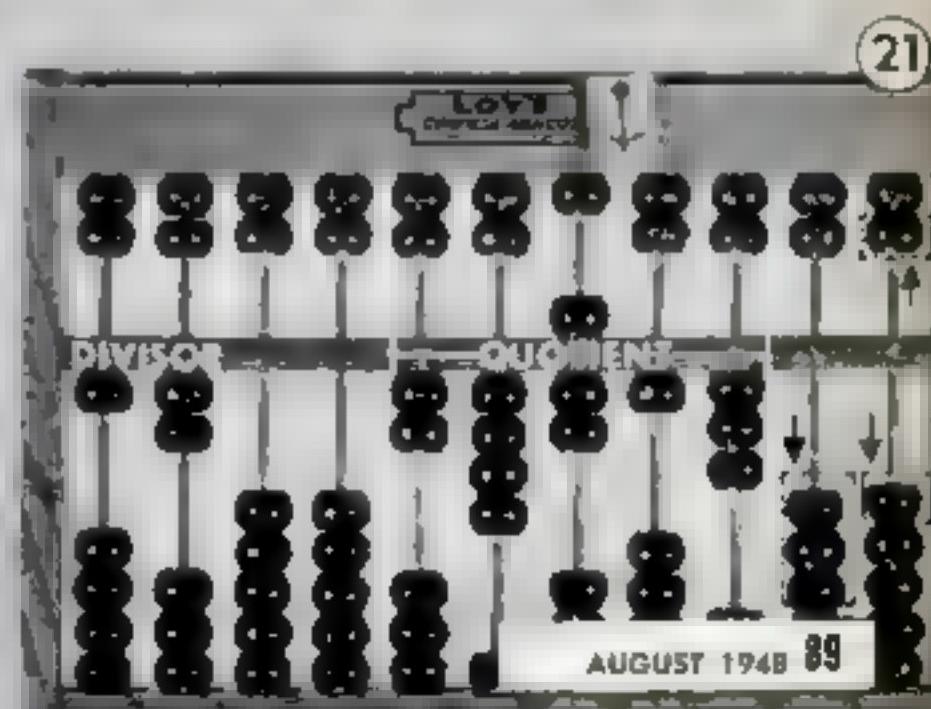
17

He starts dividing. 12 goes in 29 twice. So, in first column to left of dividend, he sets up a 2, first number of the quotient. Over it he places the indicator. He then subtracts 24 (2 x 12) from first two digits in dividend, 29, just as you do on paper. That leaves none in first column of dividend, 5 in second column



20

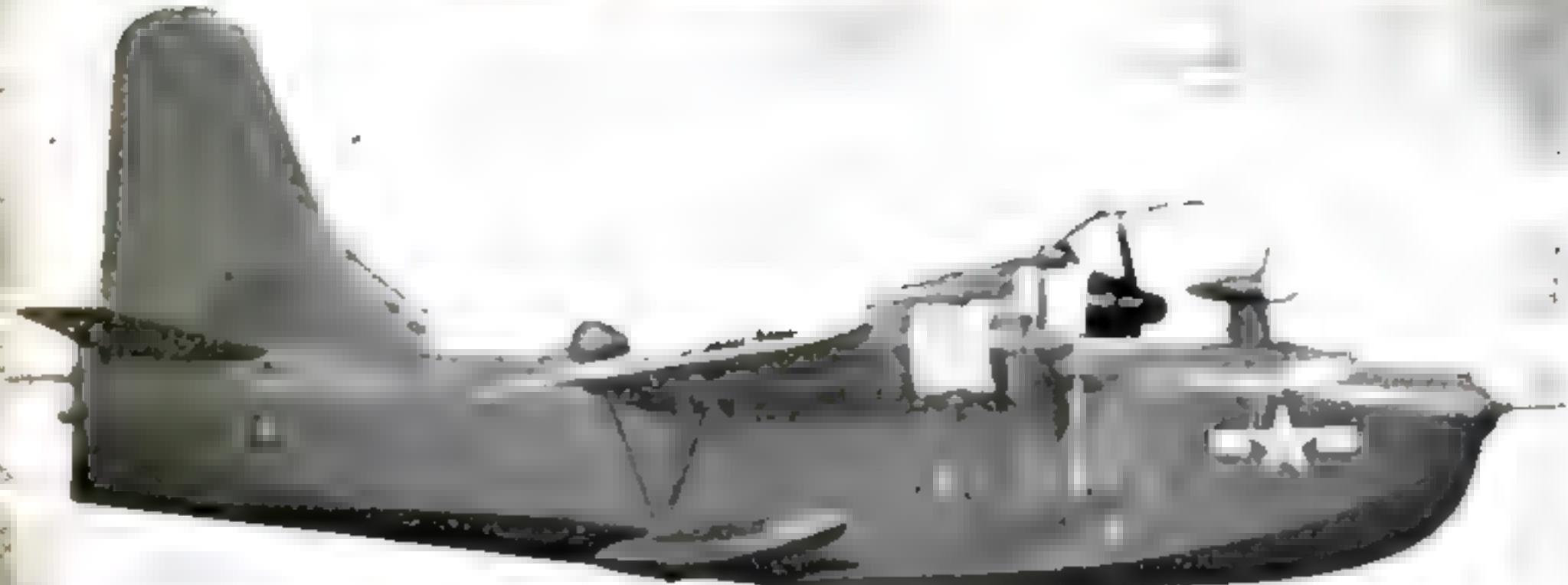
Again he divides the first two figures of the dividend by 12, as before: 12 into 15 goes once. Doe puts a 1 on the end of the quotient and moves arrow over it. Then, to subtract 12 from 15, he actually takes away 15 on abacus and adds 3. Leftover 3 and the 6 to right of it are now (below) last two figures in the dividend.



21

Problem is completed (below) by dividing 36 by 12. It goes three times even; so the two left-hand columns are cleared, and 3 is entered in quotient. Here since the answer is in dollars and cents, the indicator is set two places from the right in the quotient. The final answer is John Doe's average monthly income: \$247.13

What's New in Aviation



Longer Hull, Safer Landing. The Martin XP5M-1 flying boat shown above will put to test a new, long afterbody hull. Extended to the extreme end of the plane, this is expected to permit safer landings in rough

seas with less pitching and bouncing. It also will reduce normal take-off time and distance, since the long afterbody gives extra-clean planing. Built for the Navy, the XP5M-1 flies more than 200 m.p.h.



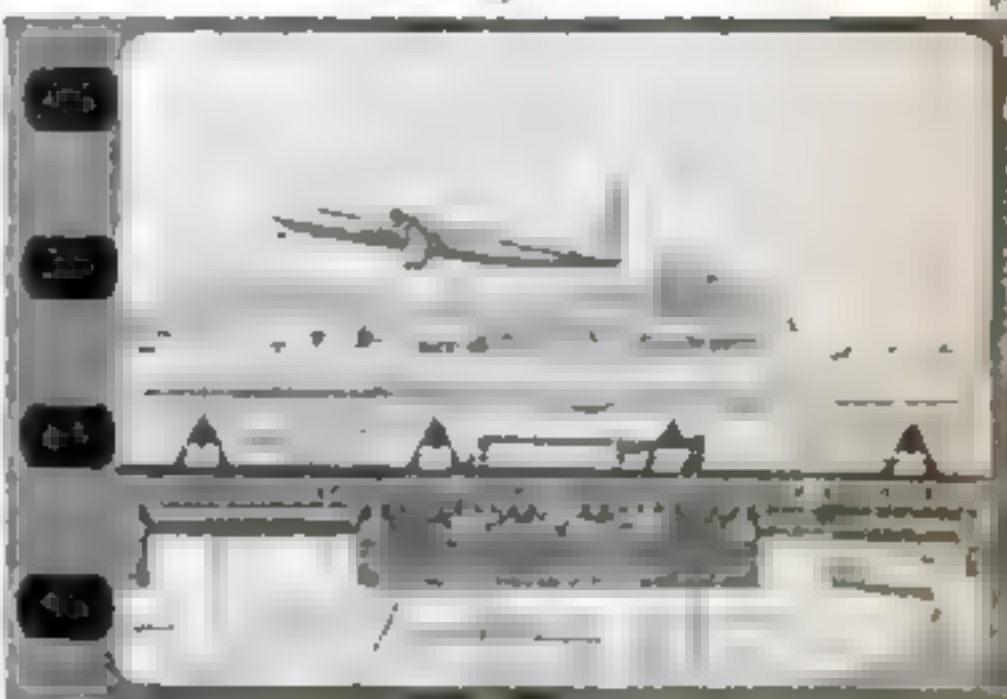
Jets Get More Power. The General Electric TG-190 (J-47) jet engine shown above weighs about the same as its predecessor, the TG-180 (J-35), but has 25 percent more power. With a thrust of 5,000 lb., it is claimed to be America's most powerful jet engine. The TG-190 has been installed in the "more than 650-m.p.h." F-86 Air Force jet fighter, and will soon power others.



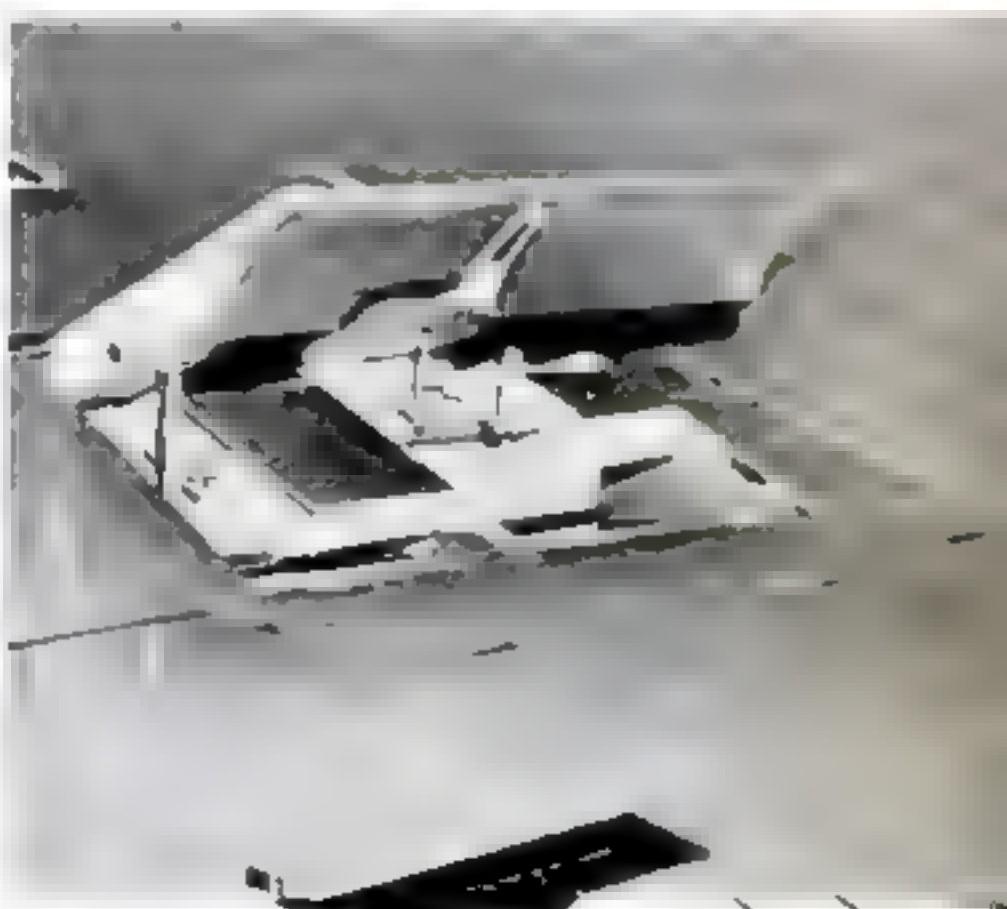
Feederliner Makes Debut. Seven passengers can fly comfortably in this new Aero Commander. It is intended for service on routes feeding into main airlines. With a range of more than 1,000 miles, it is powered by two 190-hp. Lycoming engines; speed is 181 m.p.h. The tricycle landing gear retracts. The builder is Aero Design and Engineering Corp., Culver City, Calif.



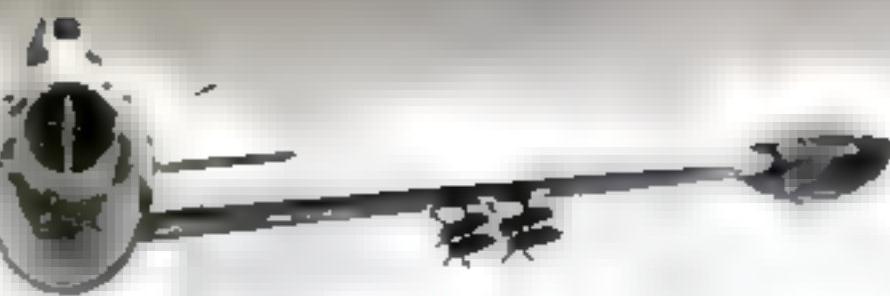
Camera Clicks Take-Off. Photo above shows how a motion-picture camera gives a mathematical determination of a test airplane's take-off and landing performance within 1/100 second. Set up behind a curved vertical and horizontal wire grid, the camera's 4½-inch telescopic lens is focused on the airplane 1,800 to 2,000 feet away. The vertical wires mark off 100-foot sections of the runway; the horizontal wires indicate altitude in 25- and 50-foot sections. Movie frame at right records that a Lockheed Constitution has gained 50 feet of altitude after a run of about 2,900 feet.



Making Jets Better. This scale model of a jet-engine compressor will "climb" to altitudes up to 70,000 feet and be exposed to temperatures from 70° below zero to 150° above—without leaving the ground. These conditions will all be reproduced in the test chamber in which it is being installed above. The chamber is part of a new GE \$25,000,000 laboratory at Lynn, Mass.



Spoilers Aid Aileron Control. The Martin-developed spoiler aileron pictured here gives the pilot extra control in banking without increasing the aileron surface. The spoilers are located inboard of the regular ailerons, just ahead of the flaps. In raised position, they help force the wings down in a turn. Spoilers on each wing operate independently of those on the other.



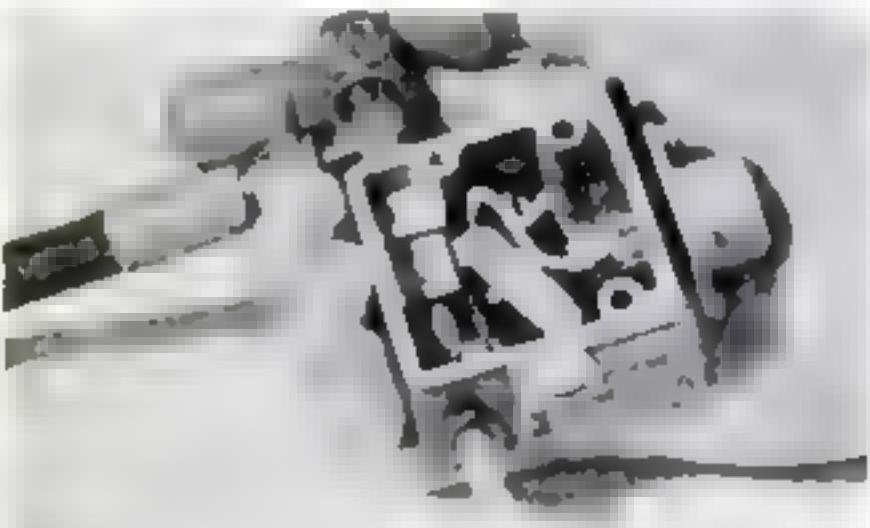
Finds Fuel Level. This built-in fuel gauge makes it easy to see how much gas there is in an underwing fuel system. It is just pulled down and out of the fuel cell in the wing, as shown above on a Martin 2-0-2. When the upper end of the gauge reaches the fuel level inside tank, holes in its tip let gasoline drip through and out the bottom, and a mechanic takes a reading on a scale marked in 20-gal. units.

Plane Resembles Torpedo. This Planet Satellite® is arranged like a ship. The 250-hp. Gypsy Queen engine is amidships, and the pusher propeller is in the stern, aft of the tail. This design is expected

Rocket Raeks Fold Into Wing.

High velocity aircraft rockets (HVAR) have increased the striking power of the Republic F-84 Thunderjet considerably—but the maximum combat speed of this famous fighter plane is as high as ever. When the rockets are fired, retracting mounts disappear into the wing, leaving no exterior obstructions to cut down speed.

Four 140-pound rockets under each wing (see left and above) are mounted in pairs but fired individually by the pilot. The rockets have a velocity of over 950 m.p.h.—half again the speed of the plane, which also totes six .50-cal. machine guns.



Fast Pressure Alarm. This switch lets a plane pilot know when the carbon dioxide in his fire-extinguishing system has discharged. The drop in the pressure of the gas activates a piston in the switch. This closes the circuit that turns on a warning light in the pilot's cockpit. The device, invented by L. J. Bordelon, Convair chief flight engineer, is made by Airite Products Co. of Los Angeles.

to reduce noise in the cabin of the British four seater as well as insure a smooth air flow over the magnesium-alloy frame. The Satellite® is expected to cruise at 191 m.p.h. and have a top speed of 210 m.p.h.



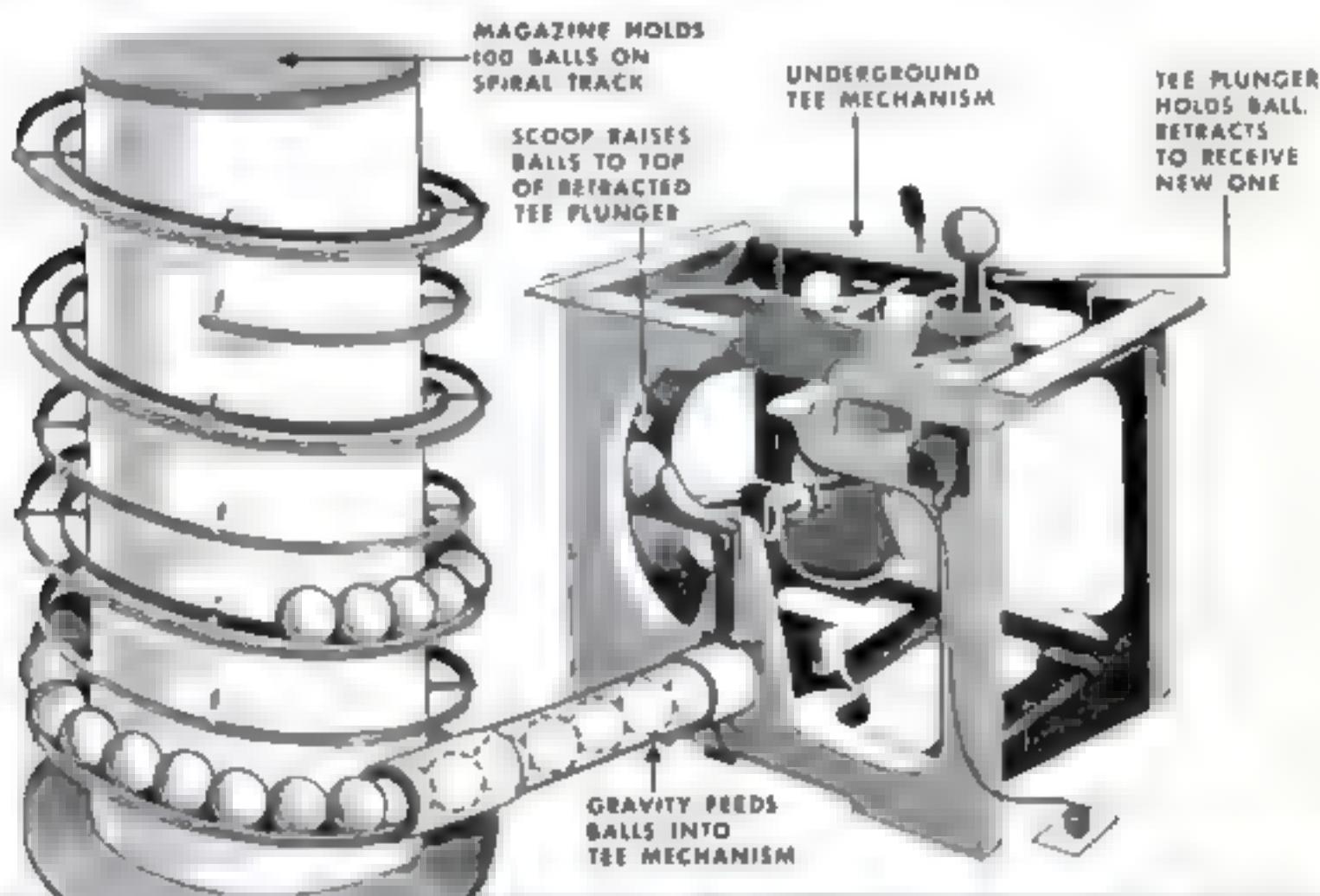
Electric Tee Helps Lazy Golfers

GOLF pro Joe Mozel has used his head to save his back—and the backs of all the duffers who spend hours just hitting balls for practice. He has invented a machine that automatically tees up golf balls, relieving practicing golfers of the bend-over-and-put-another-ball-on-the-tee routine. As fast as one ball can be hit away, another is placed on the tee, ready for the next shot.

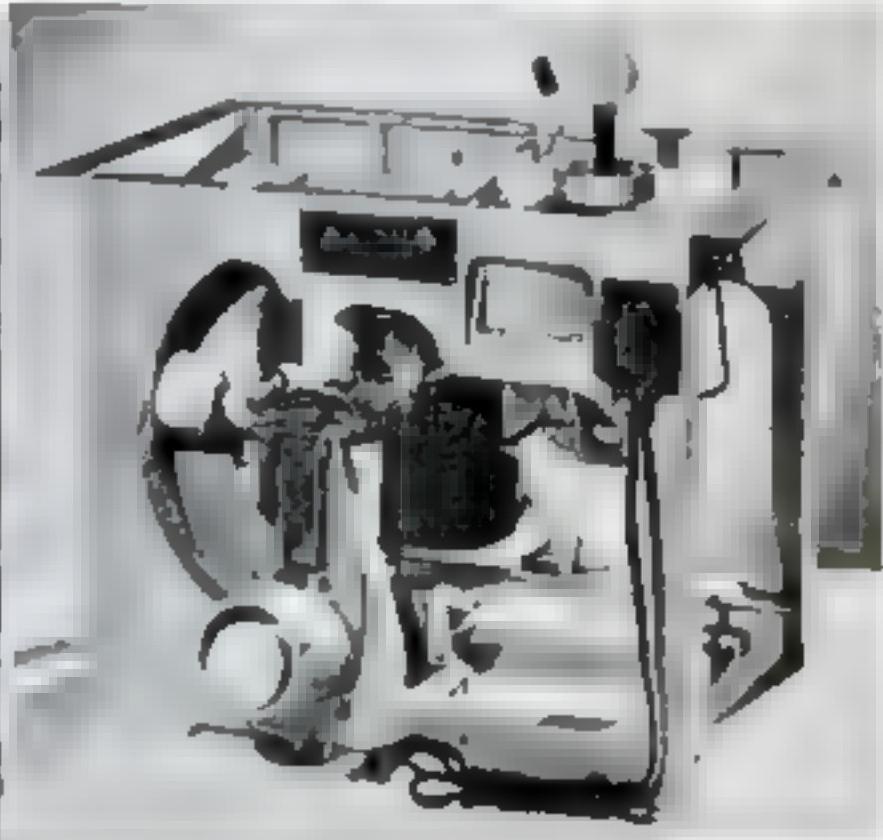
The tee-er holds 100 balls on a spiral track, down which they roll by gravity to

the tee mechanism below. Here a spoon, driven by an electric motor, lifts them up, one at a time, and places them on the tee.

The tee itself is actually a plunger, dropping down below the ground when empty and rising again as soon as a ball is placed on top of it. The ball's weight controls the action of the tee. When the spiral magazine is empty, a warning light flashes on the tee machine and also on a remote-control panel that counts the number of balls used.



Inventor-golfer Joe Mozel steps up to one of the 14 automatic tees on his Portland, Ore., practice range. Diagram at top shows how balls spiral down gravity feeder into tee mechanism. Mechanism (bottom right) is placed below



ground with only ball and tee protruding through hole. When ball is hit, unweighted tee drops back through hole, picks up another ball, and then reappears. For iron shots without tee, ball can be rolled onto brush mat to left of tee.



Midgets Invade Ball Park

Photo by Hubert Lachell

Coming out of a more than 10° banked curve, the midgets speed up for a burst along the

straightaway. Scene is N. Y. Polo Grounds where Small Car Enterprises is promoting races

WHEN the Giants go on the road these days, New York's Polo Grounds does not lapse into its usual sleepy emptiness. Instead, 200 workmen bustle out—and soon the park echoes to the roar of motors. The midgets have moved in.

For a new demountable, board track has made it possible to change a ball park into an auto race track in just 18 hours. Twelve hours after the last race the track will have vanished again—with not a blade of grass harmed. As a result, midget-auto racing, reputedly the country's fourth most popular spectator sport, has at last found a home with enough room. When the new \$150,000 track made a recent Polo Grounds debut, 40,000 seats were available—five times the

capacity of the average midget-auto track.

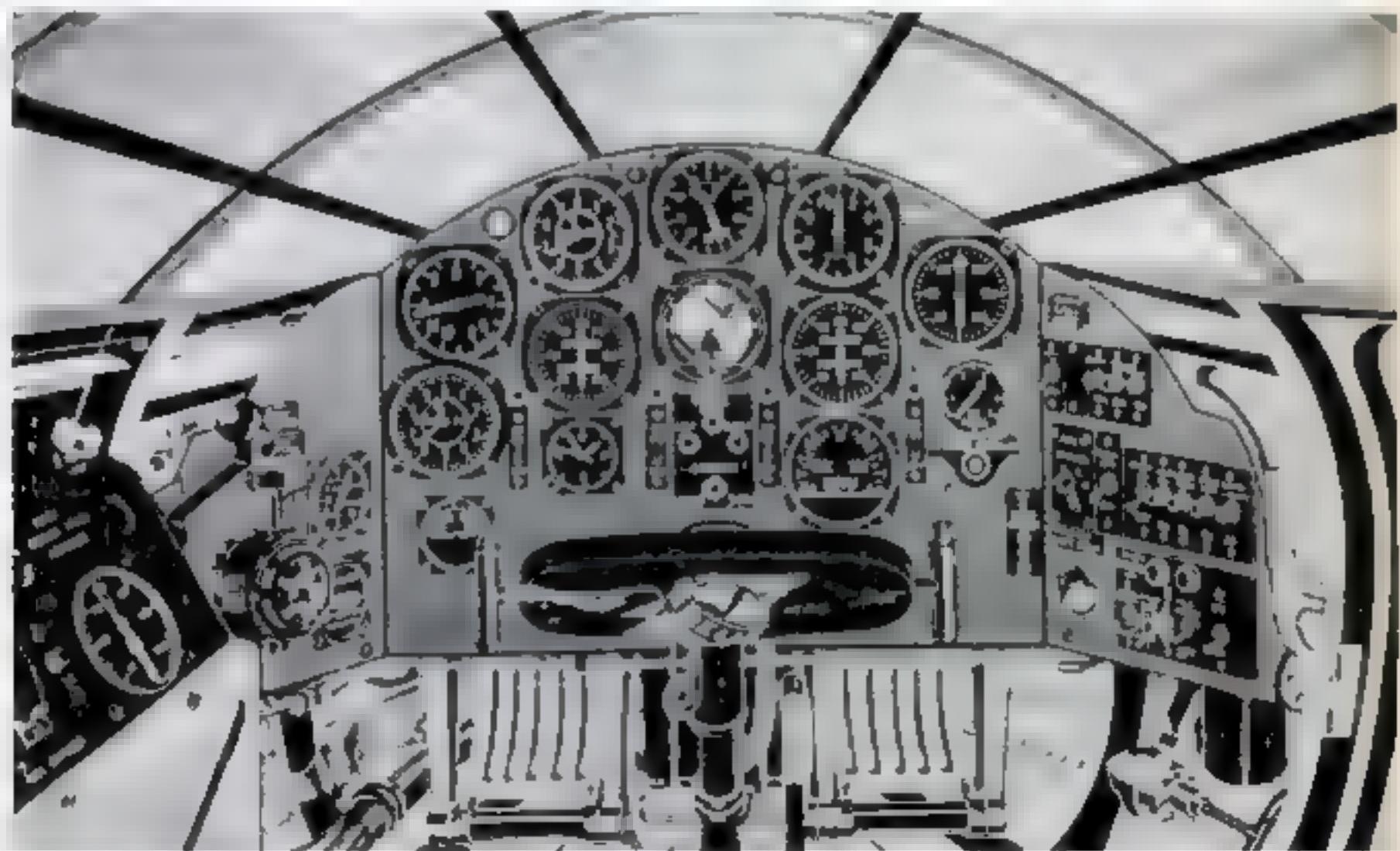
The one-fifth of a mile wood track is laid over an aluminum frame. It doesn't touch the diamond or even the edge of the out field. Boards are considered the best for midget auto racing, and the banked curves have already permitted straightaway speeds up to 80 m.p.h. When the drivers have been broken in to it, they expect to hit 100 m.p.h. On the average dirt or macadam flat track 60 m.p.h. is tops.

Speed in handling the 235-ton track was the vital problem in opening a big-league park to auto racing. It has been licked—and Lionel Levy, the New York architect who designed the track, believes the time can be cut still further.



X-1 is carried aloft under the belly of a B-29 for its supersonic flights. Berring the jet to high altitude is necessary to save its fuel since

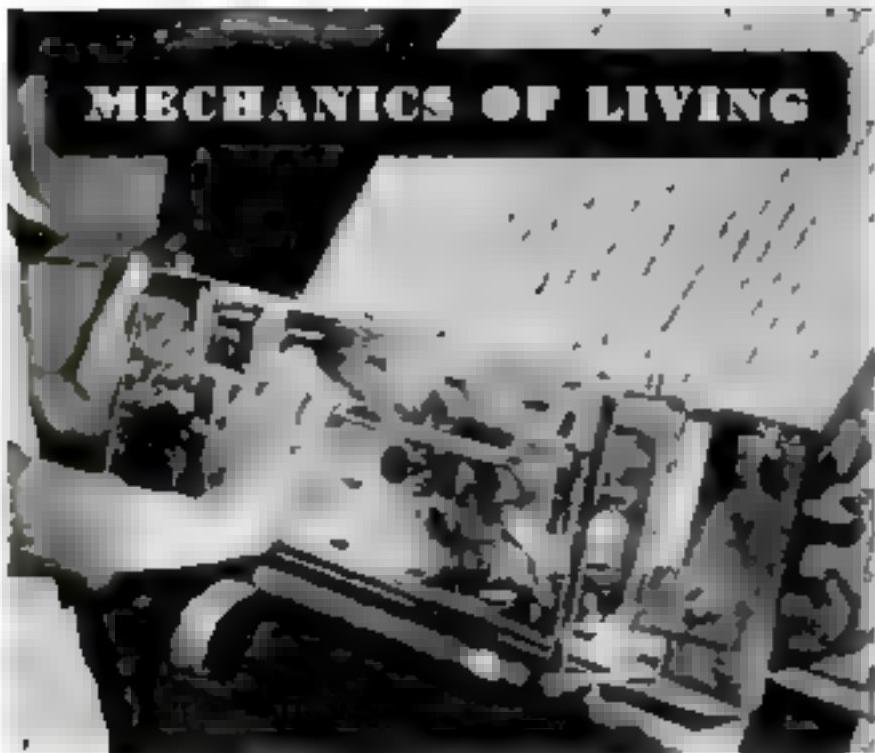
it carries only enough for 2.5 to 4.2 minutes of powered flight. Runway trench makes it easier to hook small plane to big one for take-off



Cockpit of the Bell X-1 is no more complicated than that of a standard fighter plane. Pilots complain, however, that the shape of the

nose makes it hard to look out during flight and when landing. Visibility is said to be so bad in climbs that pilots must fly on instruments.

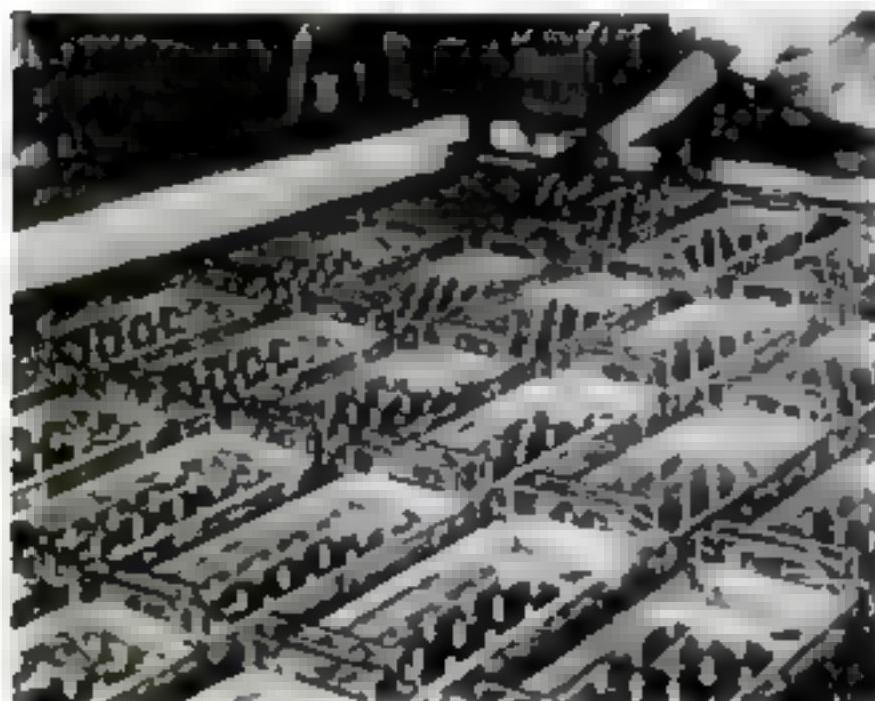
MECHANICS OF LIVING



1. Ice-cream-on-a-stick starts out as nothing but a smooth stick. This machine places 24 sticks exactly into 24 holes in holder every time the operator presses a holder against it.



2. Ice cream "mix"—cold but not frozen hard—is squirted into molds from hopper device. This operator is one of the fastest in the country; he can fill 24 molds in about three seconds.

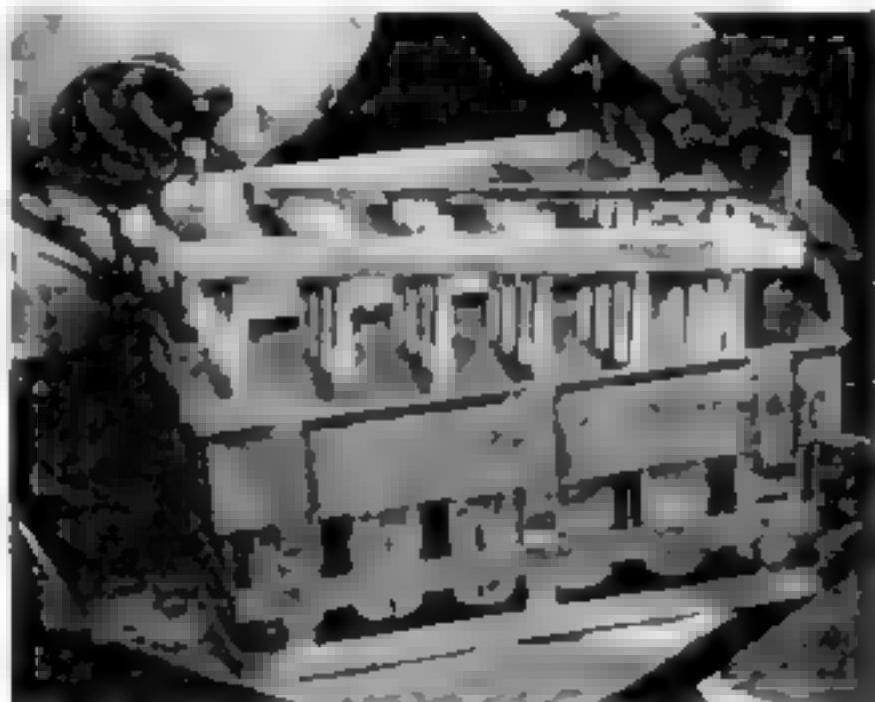


4. Salt water in the tank is kept at about 30° below zero by mechanical refrigeration. It freezes the ice cream in half an hour as molds are pushed through it by bar in background.

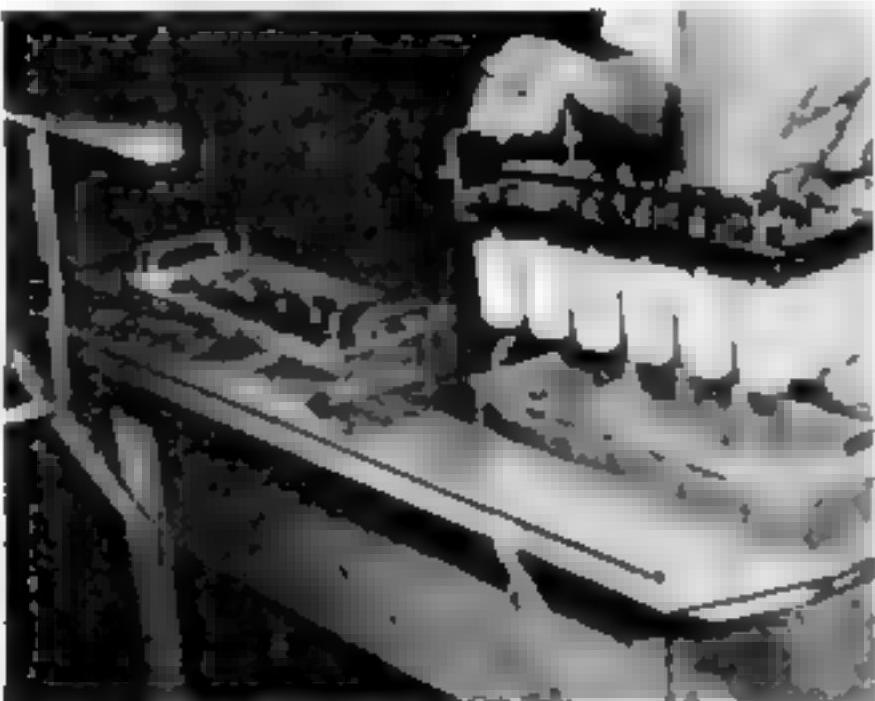
How Ice Cream

PS photos by W. W. Morris

PEOPLE have been smacking their lips over ice cream for centuries, but nobody thought of coating it with chocolate and putting a wooden handle on it until about 25 years ago. Now hundreds of millions of pieces of ice-cream-on-a-stick are made—and eaten—every year. A single modern plant, such as that of the Mayflower Ice Cream Corp., of New York, where these pictures were taken, turns out 9,000 an hour.



3. Now the stick joins the ice cream. The stick holder is taken from a rack and fitted into the container of molds. The entire unit is then dunked in a tank of brine for freezing.



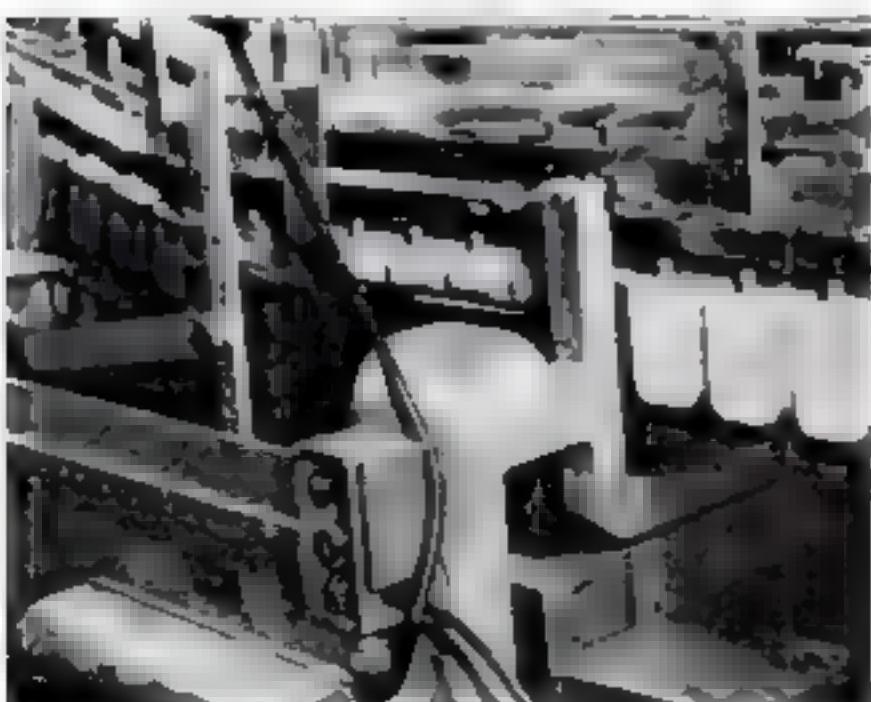
5. After trip through brine tank, molds are set in hot water for defrosting. Then the ice cream, frozen firmly to the stick, can be lifted out and sent to the chocolate-coating machine.

Gets on a Stick

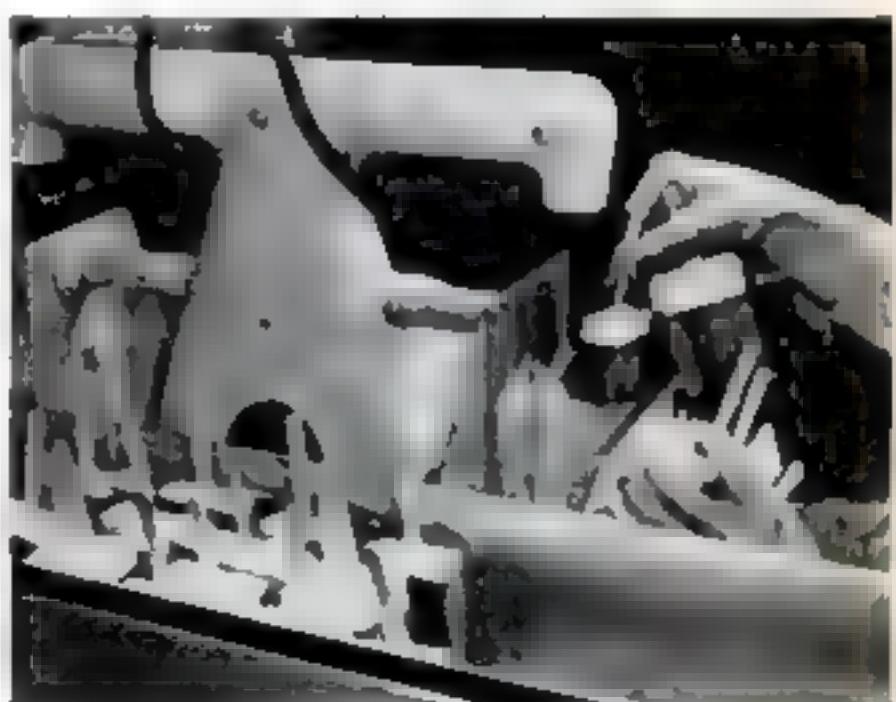


Whether you're at the ball game, the seashore, a mountain resort, or just sitting on the front stoop—you will see this picture duplicated over and over again summer for ice cream on a

stick is becoming one of the country's most popular hot-weather confections with grownups as well as the kids, riveting that traditional American institution—the ice cream cone.



6. Chocolate covering is applied automatically. Machine pulls holder into position over bucket of melted chocolate, then lifts bucket to immerse ice cream so that chocolate freezes on.



7. Fan blows bags open while girl inserts bars. This hand operation will be eliminated by device being developed by Ice Cream Novelties, Inc., firm that made other machines shown.



MARCH OF SCIENCE



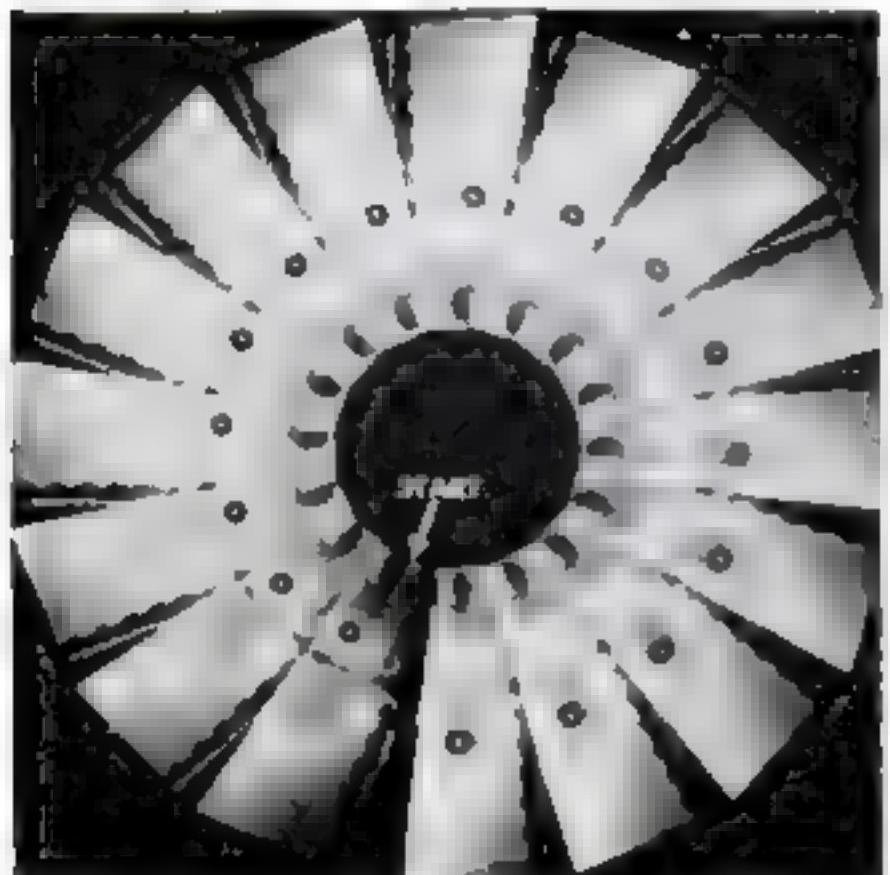
Trapping Cosmic Rays. The two pictures above show the start of an expedition to capture cosmic rays—those tiny particles, smaller than atoms, that constantly rain down on the earth from outer space (PS, July '48, p. 139).

At left, scientists of the Massachusetts Institute of Technology set their trap, a ray counter and a radio transmitter. At right are the 13 balloons that will carry the 30-pound apparatus, wrapped in cellophane,



19 miles up. Though the outside temperature there gets down to 80° below zero, the cellophane keeps the apparatus warm by admitting the sun's rays faster than it lets them out again. When the balloons break, the instruments come down by parachute.

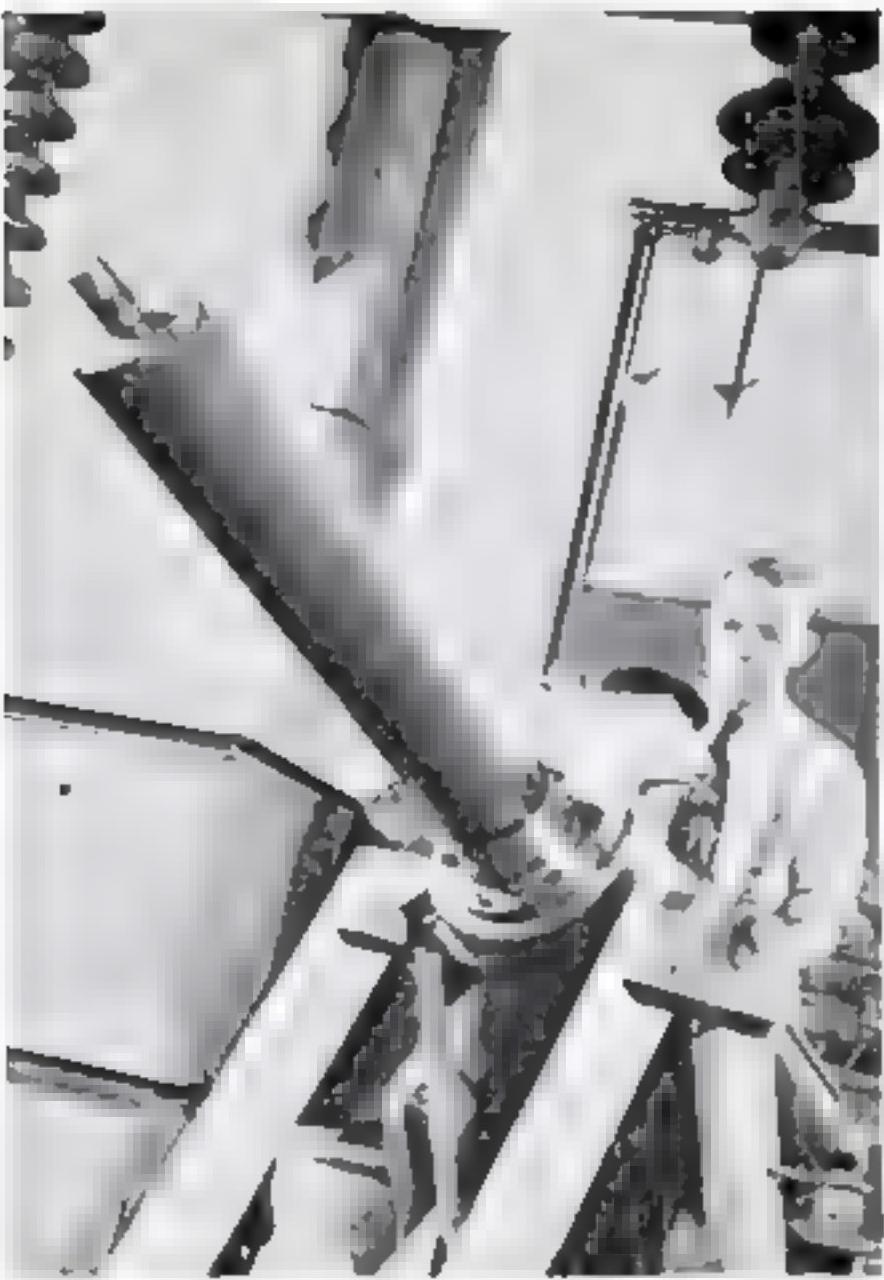
Such expeditions have found fewer electrons than had been expected among cosmic rays before they get mixed up with the earth's atmosphere. This fact may be a clue to the mystery of where they come from.



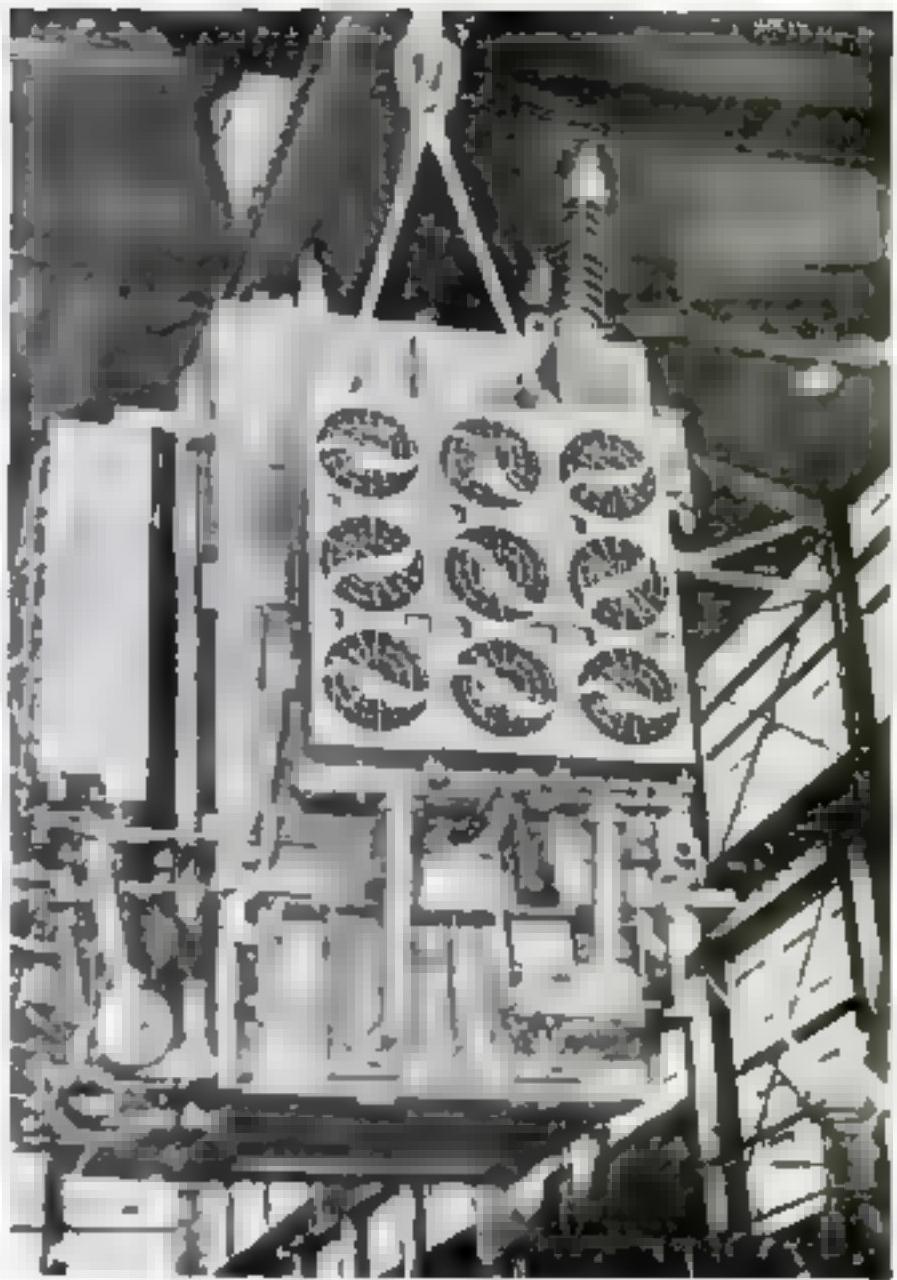
Split-Second Movie. Resembling a windmill, the odd picture at left is actually a movie lasting a fraction of a second. Photos like these, made with a high-speed camera, are helping Navy scientists to study hydrodynamic principles affecting the performance of torpedoes.

A sheet of film revolves on a disk in the camera, and a vane-shaped sector is exposed for one half-millionth of a second to make each "frame." A complete revolution of the disk, which takes 1/30 of a second, yields 16 views made in rapid succession.

The example at left shows a steel ball, released from a solenoid, or magnetic coil, dropping into a tank of water covered by an oil film. In the final frame, at bottom, it is sinking at the rate of 17 feet a second.



Cannon Fires Thunderbolts. Using this "gun," Westinghouse engineers are testing insulating gases that may replace oil in future transformers of smaller design. At the breakdown limit of gas placed in the barrel, a fiery arc leaps between electrodes. The electric potential producing the arc can be raised to as much as 600,000 volts.

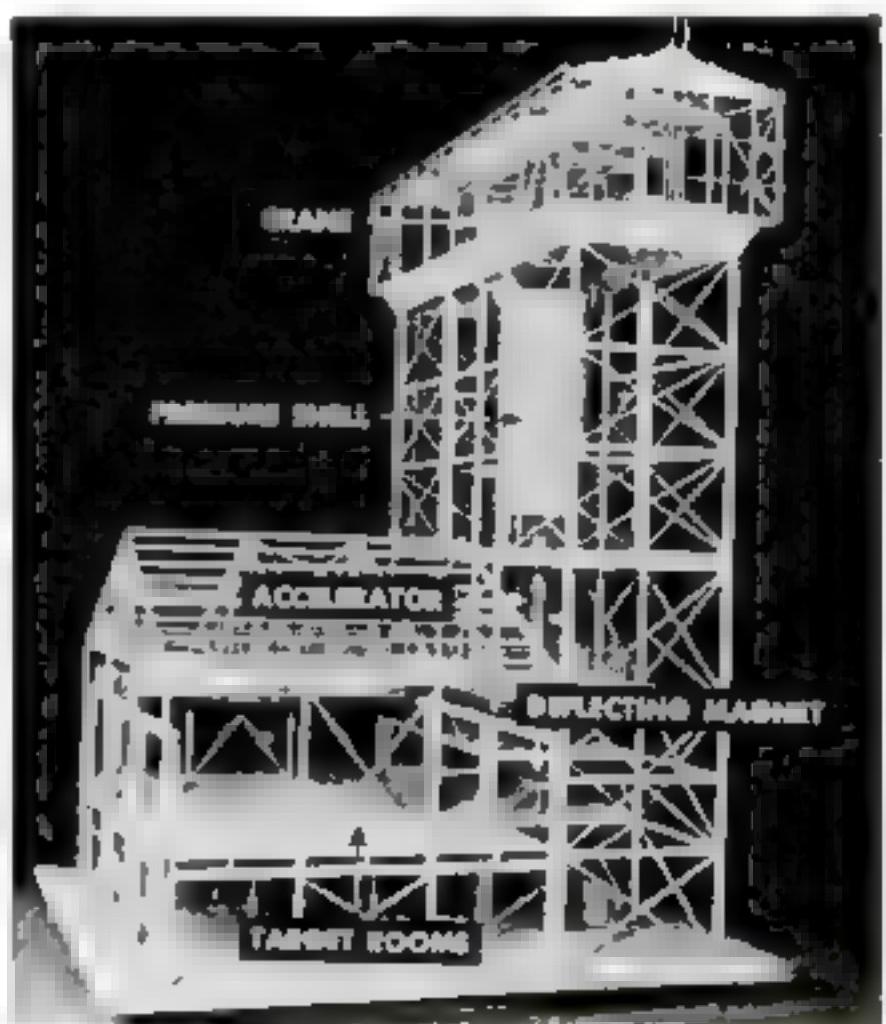


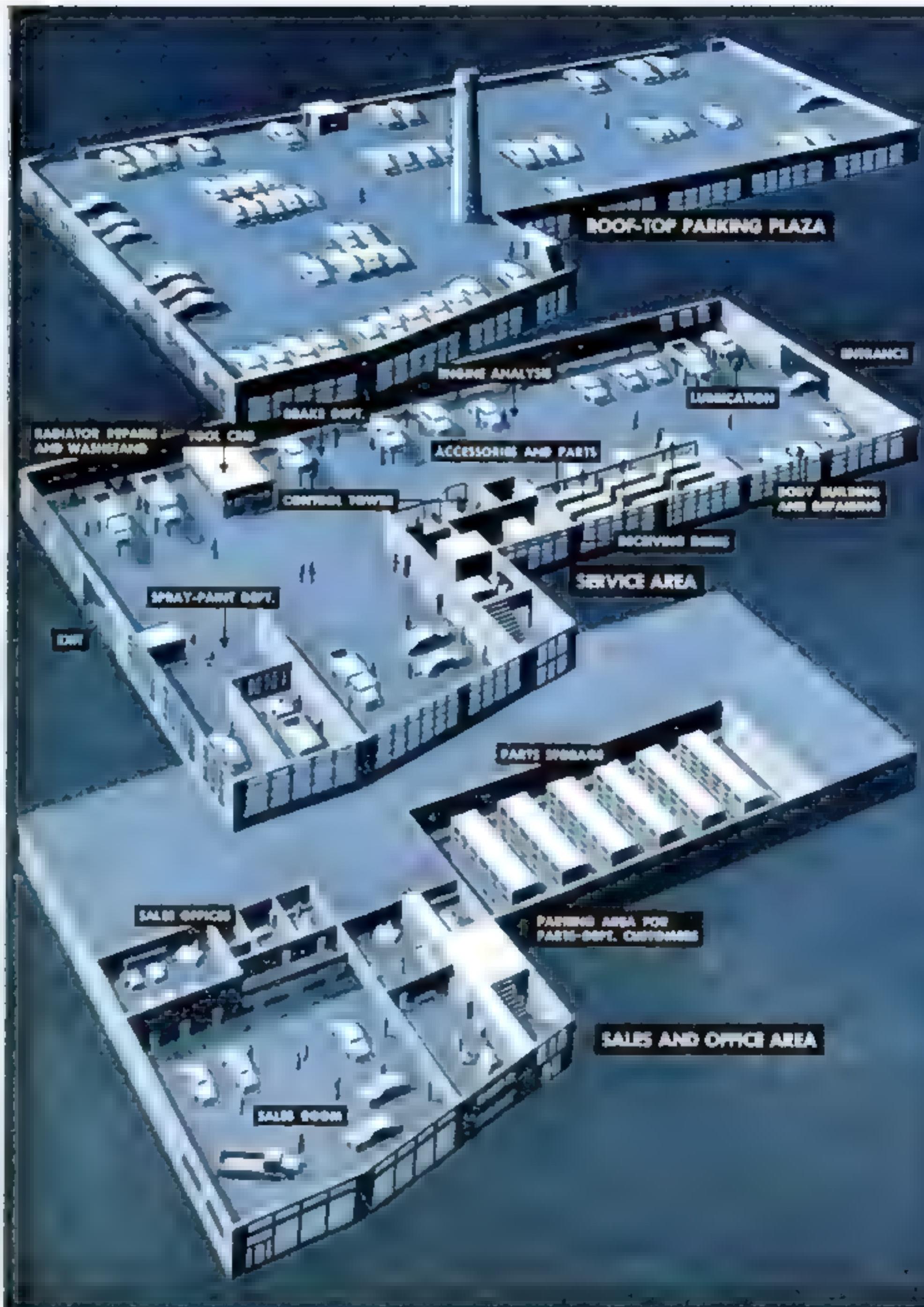
Giant Transformer. Mightiest built in the U. S., the Westinghouse 142-tonner above handles 110,000,000 watts—enough for a city of 200,000. It will step up a Buffalo, N. Y., steam power plant's juice from 13,200 to 115,000 volts to feed the area's electric transmission lines. The propeller-shaped fans cool its oil-filled radiators.

New Gun to Shoot Atoms. The L-shaped skeleton at right is an engineer's model for the biggest Van de Graaf electrostatic accelerator in the world. The Atomic Energy Commission will build it at Los Alamos, N. M., to smash atoms for research by University of California scientists.

The building, 120 feet high, will be set against a mesa cliff to brace the tower and provide a radiation shield for the control room on top of the mesa. To increase its capacity, the accelerator itself will be enclosed in a steel pressure vessel. This shell, 13½ feet in diameter and 39 feet high, can be lifted by a 150-ton crane, as shown in this view of the model, to expose interior parts for servicing.

Streams of protons or deuterons, at up to 12,000,000 electron volts, will be shot downward and deflected by a magnet into the target room.





New Garage Has Built-in Efficiency

By R. Lloyd Gayette

PS photos by W. W. Morris

DRIVING up to the service entrance of a garage that opened recently in Hartford, Conn., a new customer is surprised to see its massive door lift up before he has so much as sounded his horn.

That's only his introduction to a wonderland of mechanical efficiency that is no more like your corner service station than the

Mayo Clinic is like a country doctor's office.

This superservice station, part of the Sloate Chevrolet Co.'s new Auto Center, occupies one of three main floors in a building fitted against the side of a hill so that all have entrances at street level. Above the service floor is a roof-top parking plaza; below are offices and sales room.

In the series of photographs beginning below POPULAR SCIENCE takes you on a picture tour of this modern automobile clinic.

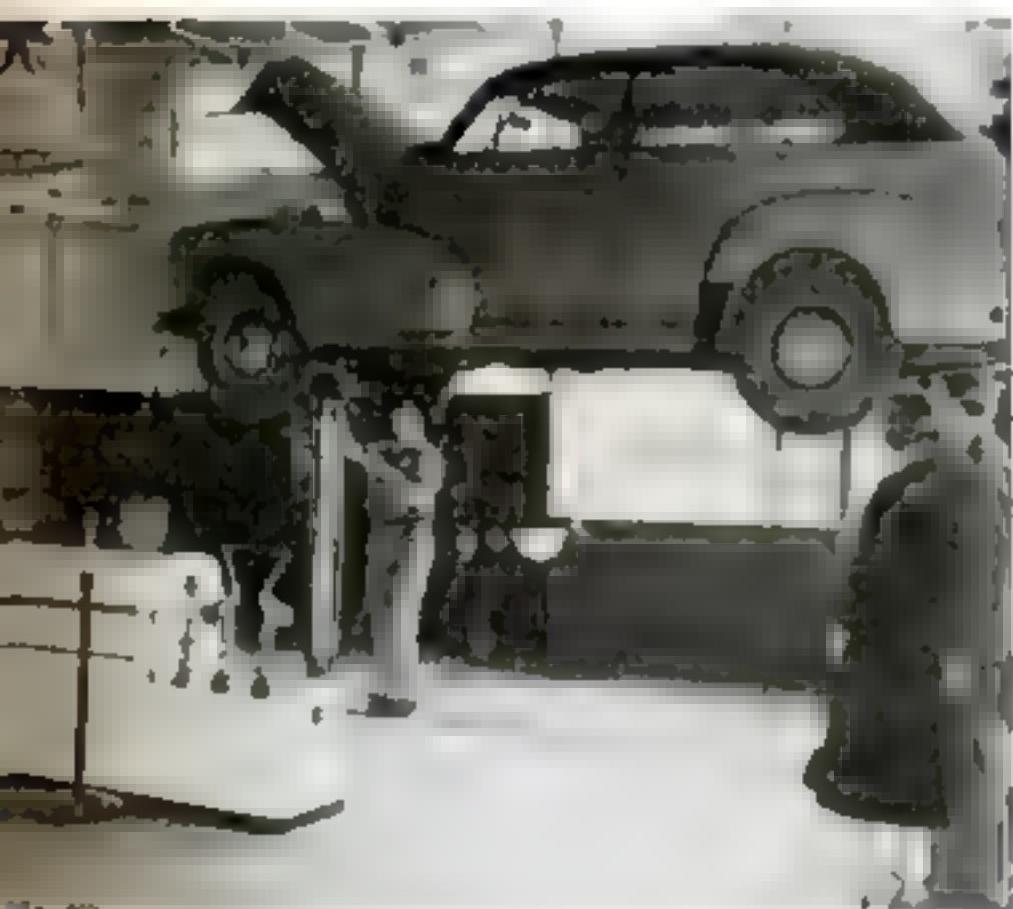


Electric eyes over entrance to superservice station open door when car breaks beams of light

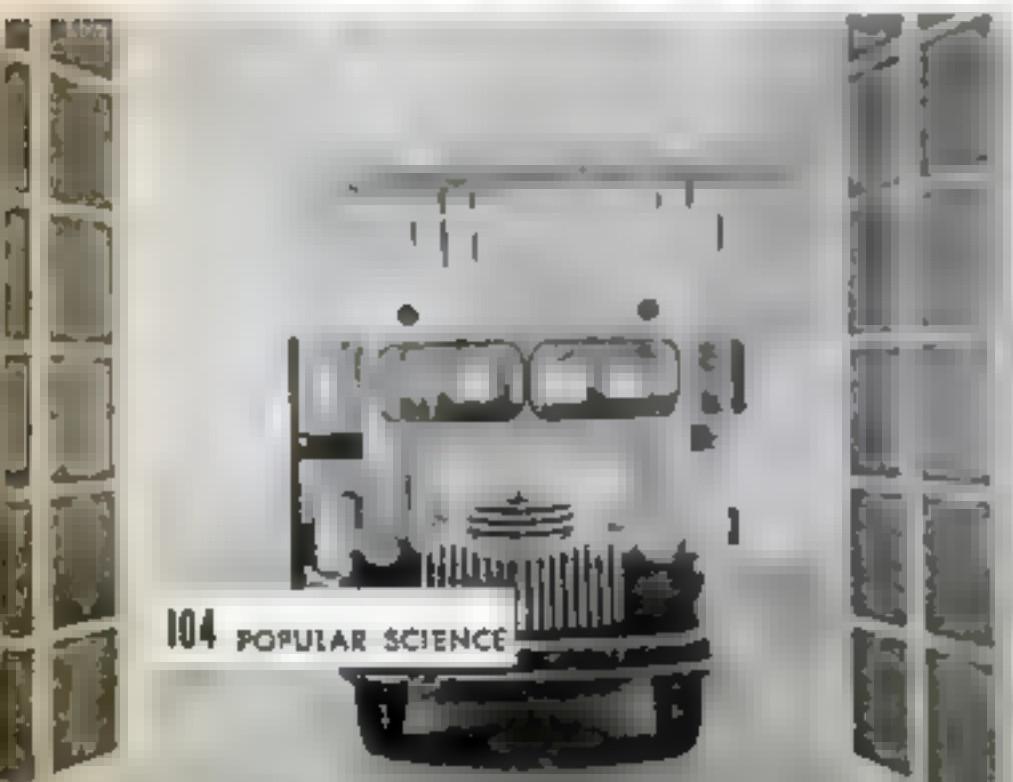
from two of several slits in driveway. Pedestrian, breaking only one beam, won't open it.



First stop inside new Hartford auto clinic is service salesman's desk one of three. Customer announces what he wants done to the car, and salesman writes out the work order in triplicate.



Lubrication department is kept spotless by drainage of waste oil—it's in foreground tank. Hydraulic lifts can raise either or both ends of a car. They will handle the heaviest trucks.



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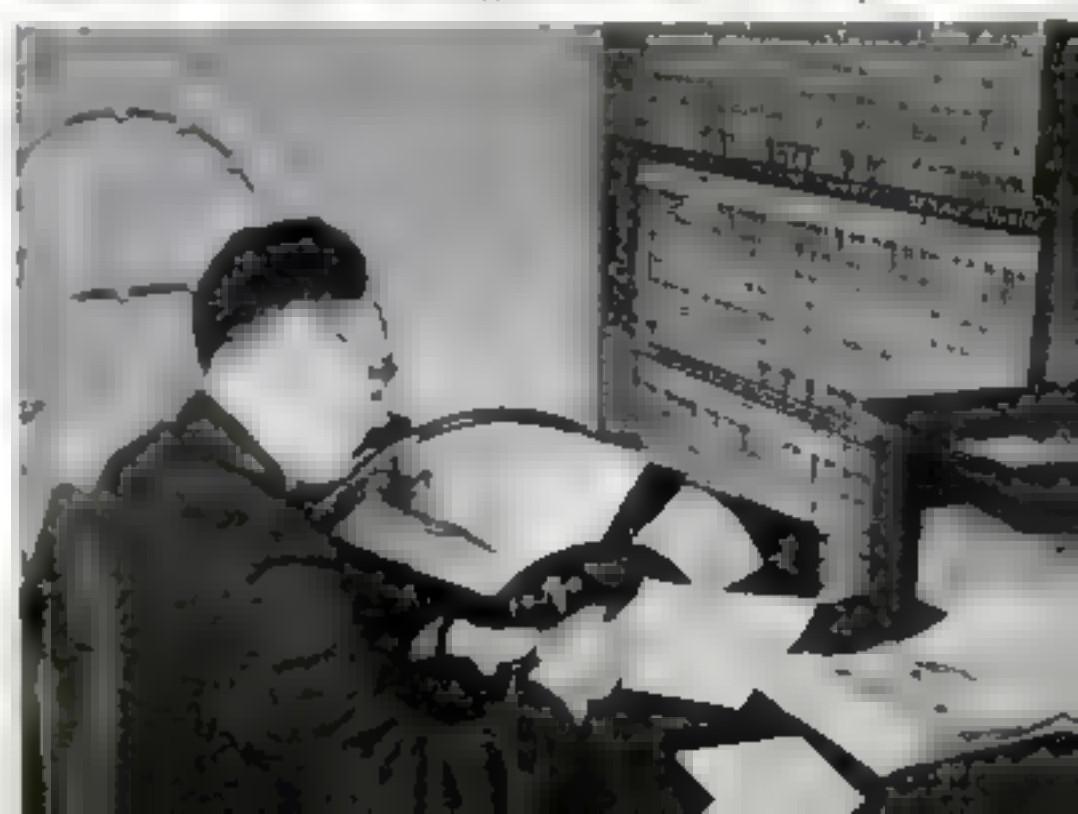


Pneumatic tubes carry copies of work order from salesman to dispatcher in control tower. To right of tubes is sound-insulated booth with both a foreign microphone and outside phone.



New oil is drawn by gravity from tanks hung from the ceiling, eliminating pumps. Tanks can be rotated from the roof-top parking plaza without a tank truck having to enter the building.

Clerk makes card record of each servicing job and posts it on board below. From that, Auto Center mails reminders to customer after 30, 60, and 90 days to bring car in for checkup.





Dispatcher in glass-enclosed room on mezzanine of service department directs flow of all work. From chart showing progress of each job he can tell customer when car will be ready.



Exhaust fumes from car during motor tuneup or when tirely tubing are carried off by flexible suction hose to duct under floor. Fans change air throughout building four times every hour.



Customers waiting for cars to be serviced may relax in attractive showroom below decorated with mural depicting history of transportation. Loudspeaker tells them when cars are ready.



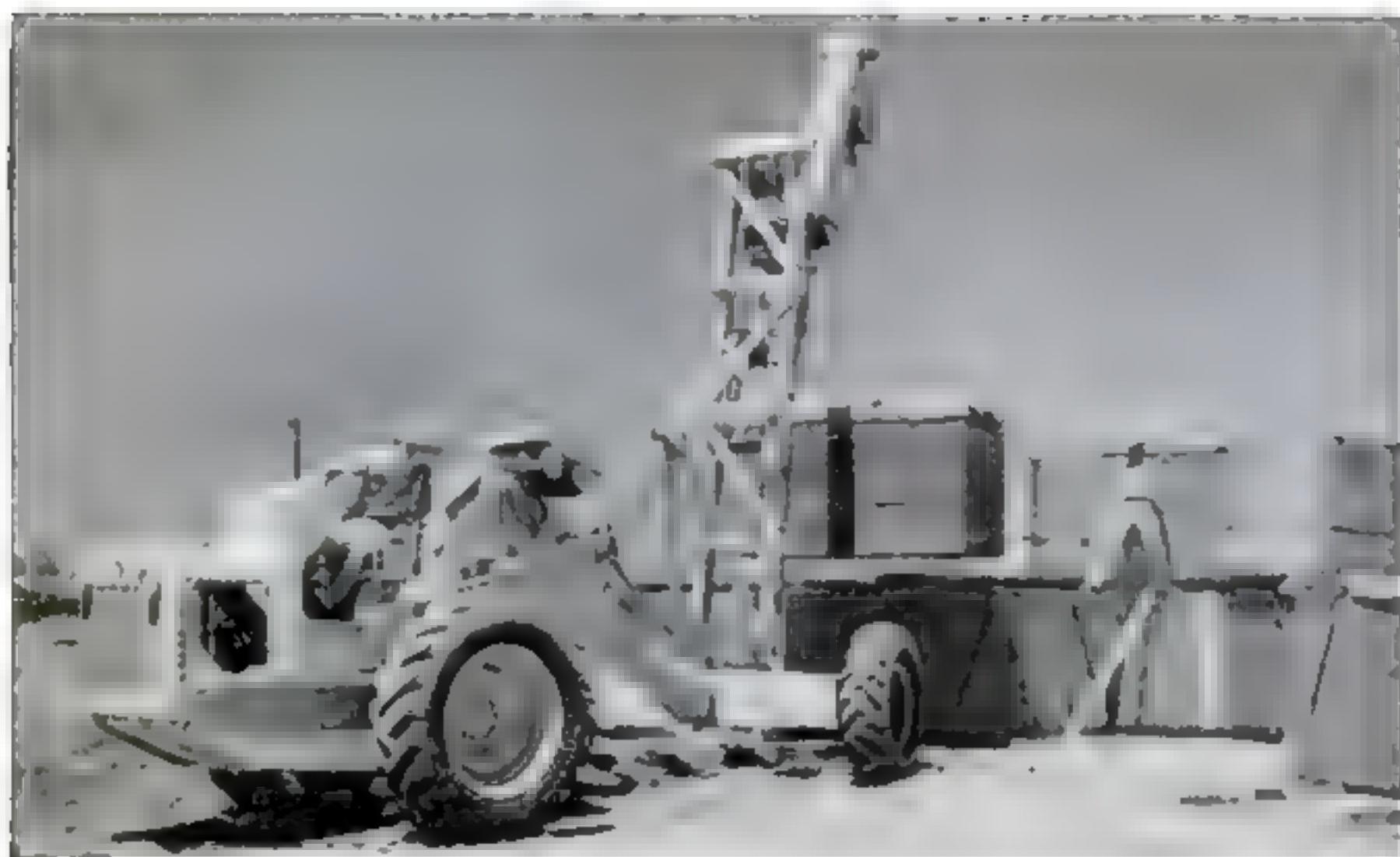
Signal panel controlled by dispatcher shows salesmen what sort of jobs to accept for immediate attention; green light for yes, red for no; yellow as a warning to check with dispatcher.



Accessories are displayed just above salesmen's desks to catch customers' eye when he leaves car. New parts needed for any repair job are ordered from here by the dispatcher.

Showroom lighting fixtures (below) hold both fluorescent lamps for general illumination, and small spotlights that can be focused individually on the used and new cars on display.

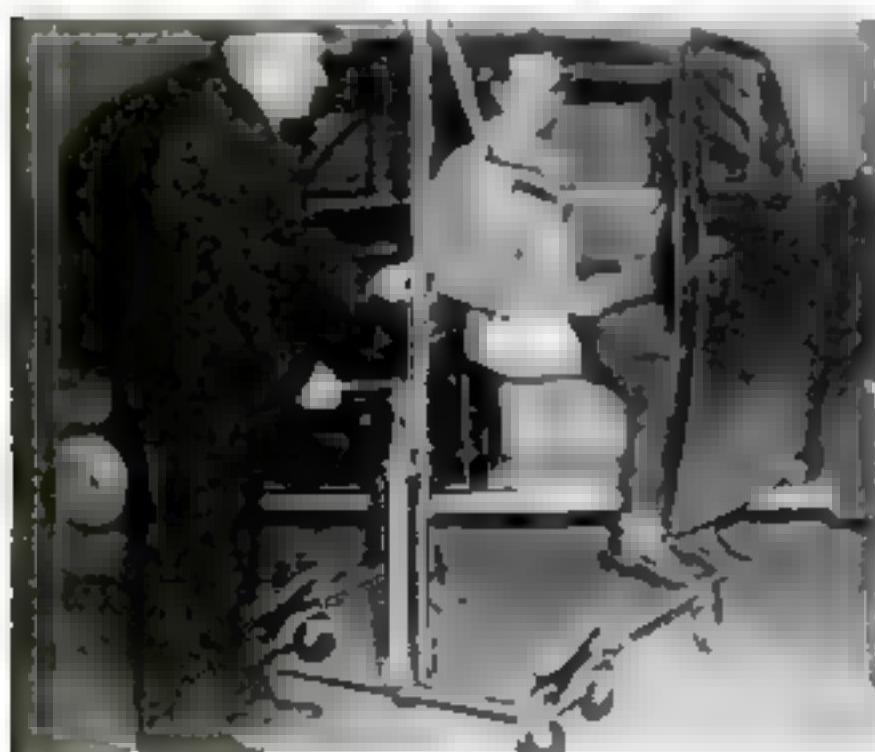




Crane Lifts Big Load

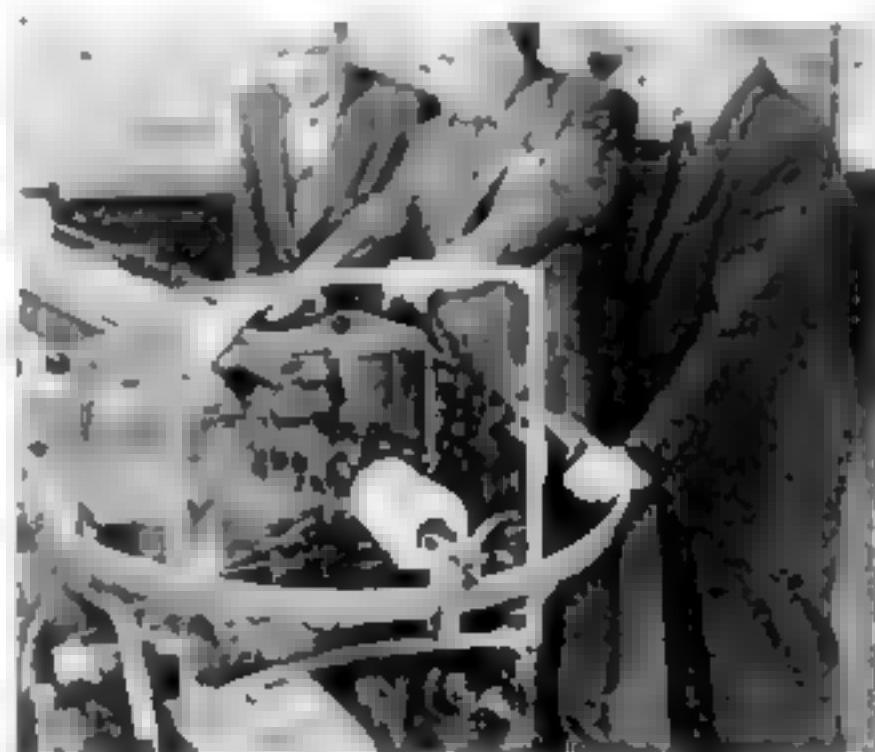
This one-man, mobile Tournacrane $\textcircled{1}$ carries a 7-ton load and turns on a 20-foot dime. The boom rides up and down on an elevator track, providing a 31-foot reach

when fully extended. The track tilts backward to a horizontal position, and can be tipped forward to bring the load over wheels for better weight distribution. Three electric motors operate pulley, boom, and elevator track, while a fourth steers the crane.



Invalids Get a Lift

INVALID patients get a lift—literally—with this Porta-Lift $\textcircled{1}$ for home or hospital use. One person operating the hydraulic jack at the side can lift a patient into or out of beds, wheelchairs, or automobiles. A seat hanging from an arm at the top of the wheeled stand supports the patient in either a sitting or reclining position. "Outrigger" wheels give good stability and can be folded out of the way when not in use.



Machine Weaves Faster

AN ENDLESS stream of high-speed, steel shuttles replaces the usual single, wooden shuttle in this new Swiss-designed weaving machine. Made by Warner and Swasey, the "rapid-fire" loom has nearly three times the cloth output of ordinary machines. Lacking a bobbin, each shuttle grips the thread to make only one trip across the loom. It then releases the thread and drops onto a conveyor that carries it back for later use.



Handy Box Aids Driver

This versatile box, shaped to fit a car seat, can do four jobs for a motorist. Closed, it serves as a picnic-lunch box and at the same time as an arm rest for the driver or an elevated seat for Junior. Opened, as above, the hinged cover reveals a vanity mirror that swivels to any angle. The Auto Bed Shop, Los Angeles, sells it for \$13.50.



Chair Doubles as Lounge

This cross between a deck-chair and a rocker lets you lean back and put your feet on the desk—without a desk. Thanks to the angle in the bottom rails, it can either be used semi-upright or tilted way back, as above. Called the Barwa, the chair is said to be scientifically shaped to the natural contour of spine and legs in relaxation.



Camp Stove Fits Pocket

The new camp stove shown above takes little more room in a sportsman's pocket than a fishing reel or a box of shotgun shells. When folded (inset) the Taykit measures only 5 by 4½ by 1½ in. Set up, with the carrying-case walls pushed out as wind-shields under two sides of a wire grill, it's big enough for a frying pan, a coffee pot, or a four-quart kettle. The stove burns gasoline, but needs no pressure pump. Cupping your hands around the burner warms air in the fuel line to squeeze out a drop for a generating flame, and the stove's own heat keeps up the pressure. It will burn an hour and a half on one four-ounce filling.



Baby Cart Has Rockers

The Babycar, above, was recently shown for the first time at an industrial fair in Holland. The wheels let down to lift it off the rockers, and a handle can be fastened on at the front to pull it by.

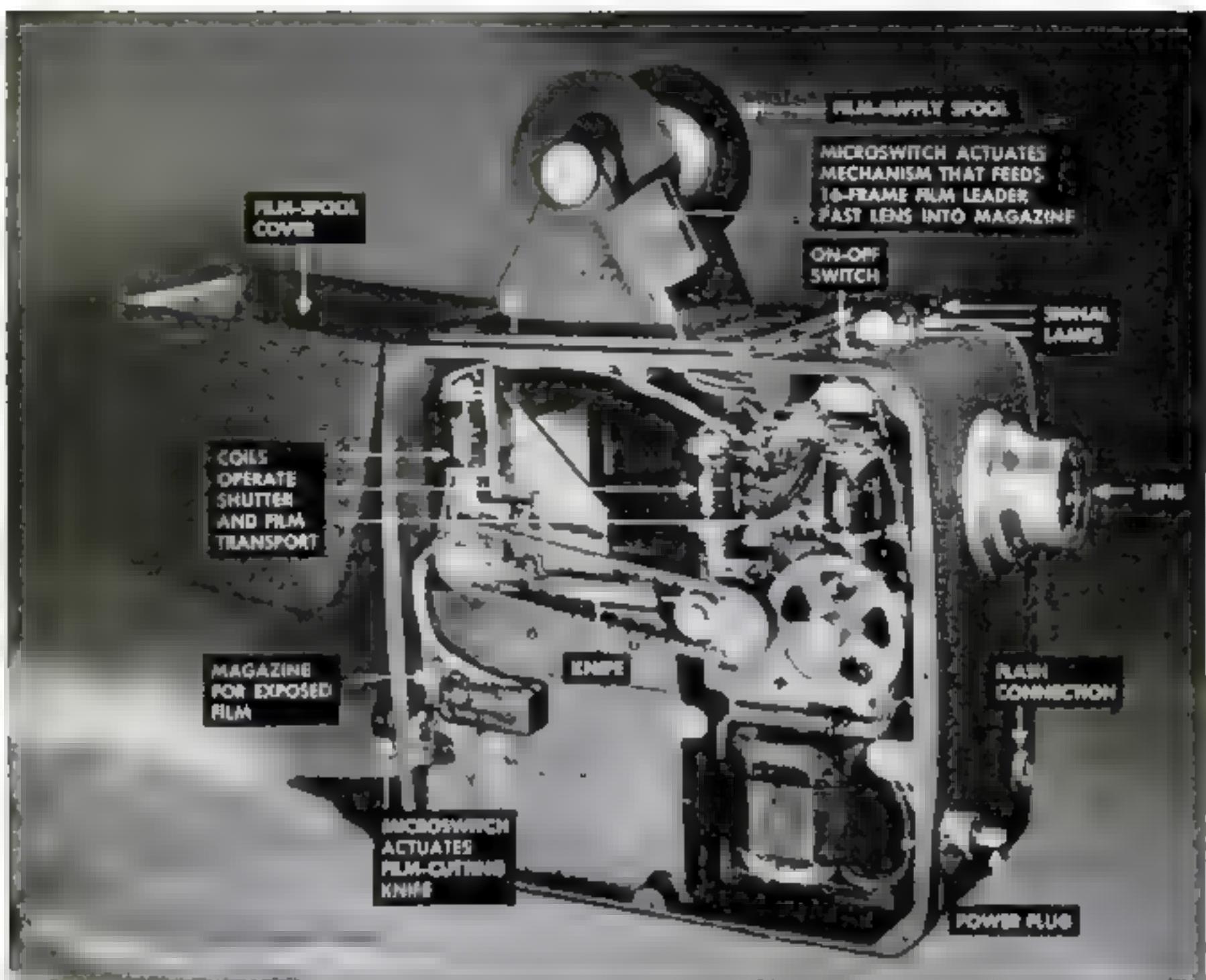


Photo-Metric camera, shown open, is easy to run, almost foolproof. As soon as one 70-mm. film frame is used, another moves automatically into place, preventing double exposures. Push-button snap switch operates knife that cuts frames apart so salesman can remove exposed

film at any time. Two synchronized flash lamps have life of 10,000 flashes, need infrequent replacement. Shutter speed is fixed at 1/10 second, lens aperture at f/8. Red light warns when film spool is empty; white, when power is on; amber, when picture is being taken.

Contour Maps of Men Aid Tailors

By Paul F. Ellis

PS Photos by W. W. Morris

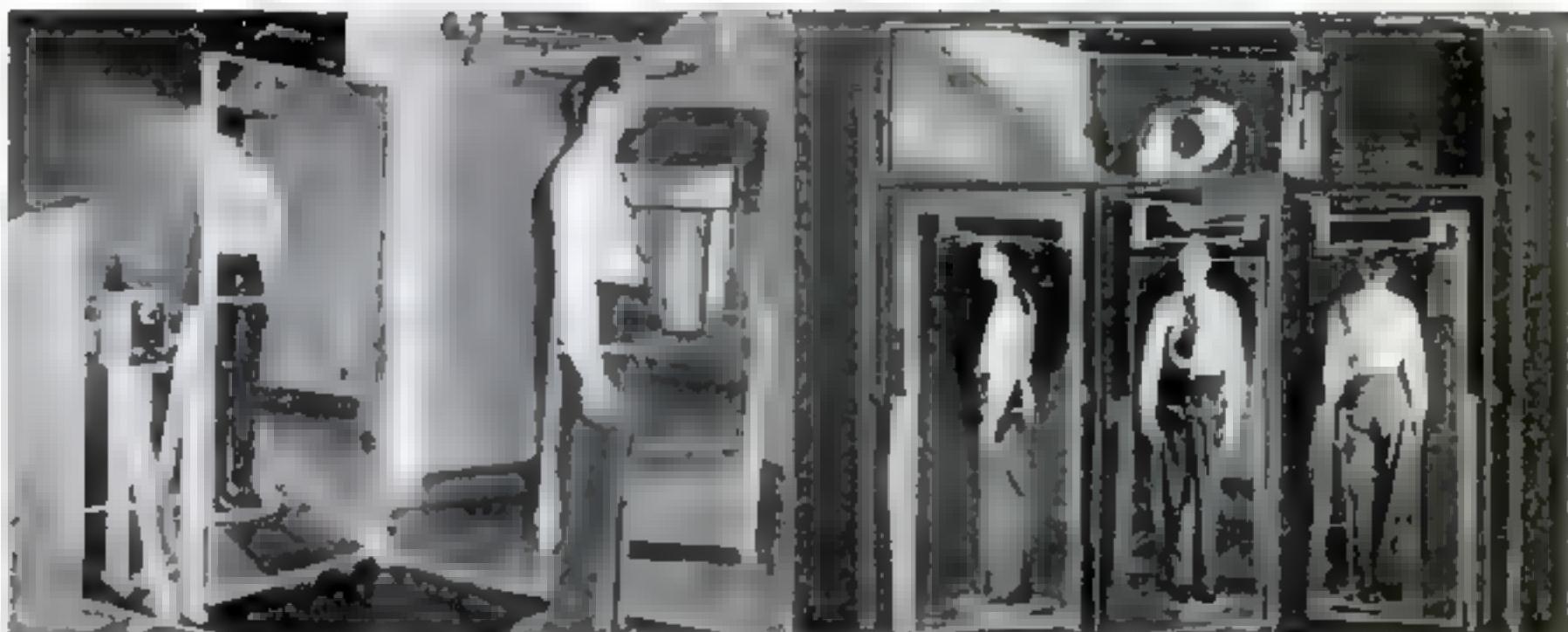
MAKING a suit of clothes really fit a modern man's bulges, slopes, and protrusions is difficult craftwork. But engineering, physics, and optics have been combined now in a Photo-Metric® process to help both tailors and their customers.

It requires a unique camera, a set of mirrors, and a tricky calculator. Henry Booth, president of Amalgamated Textiles, Ltd., invented the system, and it has been introduced by a subsidiary of his company,

which is licensing its use by retailers and manufacturers.

When you order a suit made this way, you will be asked to stand on a low pedestal and be photographed. You will wear a harness made of tape measures bearing large numbers showing your measurements. Your name and address will be photographed along with you. Then the suit will be made. You will not have to return for fittings or adjustments.

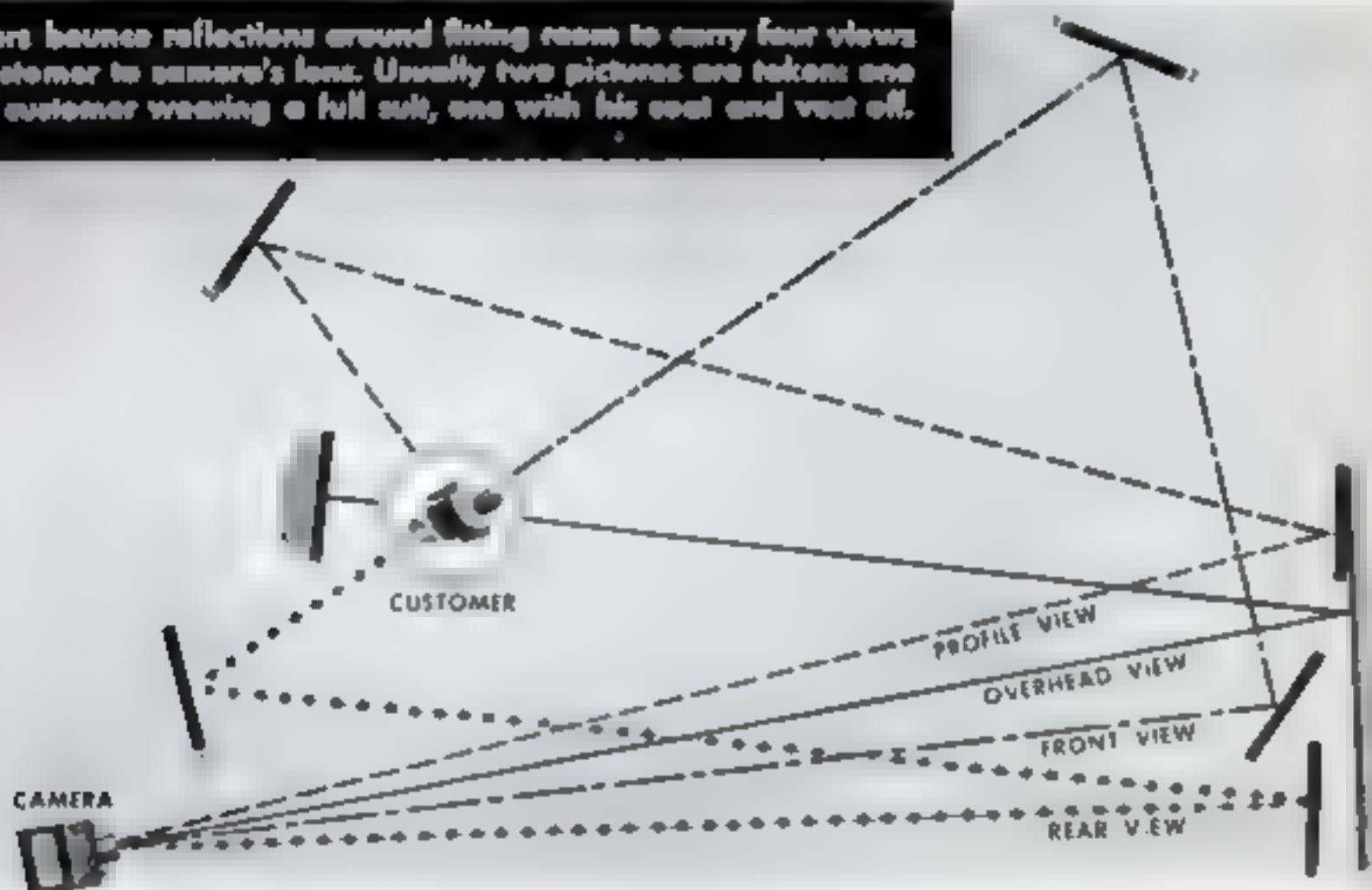
The camera, designed under direction of Eastman's Dr. Kenneth Mees, is the heart of the entire technique. The salesman



Customer being fitted for suit wears harness of tape measures and stands on platform surrounded by mirrors. These reflect his image—as seen from front, rear, side, and overhead—to

camera in corner of room. When salesman presses button, all four views (shown at right above) are photographed simultaneously on a single frame of film in a fraction of a second.

Mirrors bounce reflections around fitting room to carry four views of customer to camera's lens. Usually two pictures are taken: one with customer wearing a full suit, one with his coat and vest off.



using it is said to need only a half hour's instruction, principally on how to load the film. The focus, the shutter speed, the light values are all permanently set. To load the camera, the salesman raises the cover. No threading into sprockets is required; the operator merely places the spool of film on the spool holder and inserts the film leader into a slot until it comes to a stop.

As the cover of the camera is tightened down, it trips a switch that automatically puts the winding mechanism into operation so that the first 16 frames are run through without any pictures being taken. This is

insurance against the use of exposed film at the beginning of the roll. To extract the film, the salesman presses a button that activates an electrically controlled lock, automatically sealing off the magazine from outside light or dust. It isn't necessary to wait until all the film on a roll has been used up; it can be chopped off any place by pushing a button.

The picture taken by this camera is a multiple reflection of the customer's images as they appear in four optical mirrors. The negative is developed and placed on a slide. This goes to a workroom where "blue pencil



Clerk reads measurements from four-way image thrown on large translucent screen from back by projector focused on mirror at left. This method of projection lets him work close to the picture without standing in path of the light. Image is enlarged to a predetermined fraction

of customer's actual dimensions. Clerk is using calibrated map-measuring device to study every detail of posture and build that will be used in tailoring suit. Horizontal bar across screen can be moved up or down to see whether, for instance, one shoulder is higher than the other.

men" view the projected negative on a large screen. These experts read off the measurements from the projection and put them on a pad.

The data obtained this way is then fed into a "calculator." In it, the Photo-Metric Corporation previously has placed what it estimates to be the normal measurements for any certain size, such as a 39 regular, a 42 long, or a 36 short. The calculator, according to the company, presents estimates for about 500 different patterns of men's clothing. The customers variations from one of these are determined with the help of the calculator and a slide rule. The cloth can then be cut and the suit completed. END

Neat Trick if You Can Say It

PAUSING several times to take a deep breath, a speaker recently told the American Chemical Society that piperonyl cyclonene is a mixture of chemical substances, the most important of which is "hexyl-5-(3, 4 methylenedioxyphenyl)-3-carboxy-2-cyclohexen-5-one."

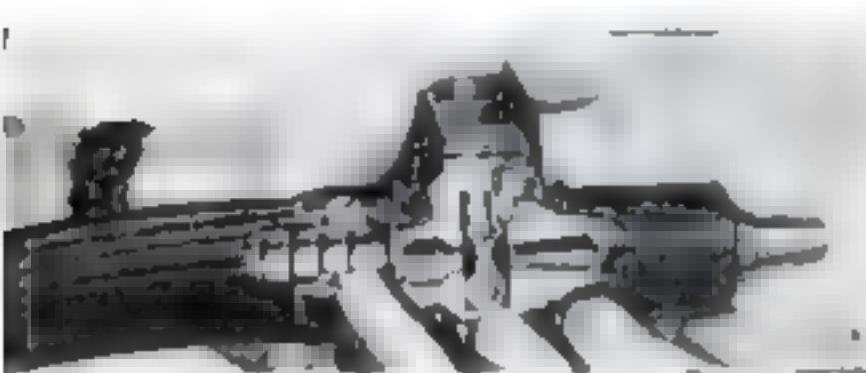


Slide-rule calculator works out the final figures to guide tailor in cutting material for suit. It determines these by comparing customer's actual measurements with dimensions of various standard sizes for different models. Scale is set in advance for particular type and style of suit wanted.



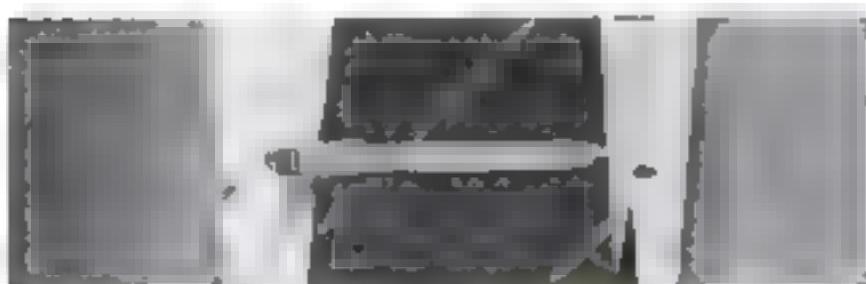
Trains Get Ferry Ride

WHEN the giant "jaw" at the right snaps shut, it swallows 30 railway cars. It's the upper bow section on the Danish ferryboat *Fyn* (above), which carries railroad cars on the 15-mile run between Nyborg and Korsor. Rising like a drawbridge, the bow permits railroad cars to roll directly from tracks on the dock to tracks on the ferry's deck. The modern ferry can also carry 1,500 passengers. It cruises at better than 16 knots.



Water Shuts Hose Valve

THE water itself does the work in this self-closing Paul valve for water hoses. The opening into the nozzle is smaller than the valve chamber, so the water must speed up to get through, causing a drop in pressure at the opening. This forces a ball inward against the opening, shutting off the water until the plunger on top is pressed down, pushing the ball away from the opening.



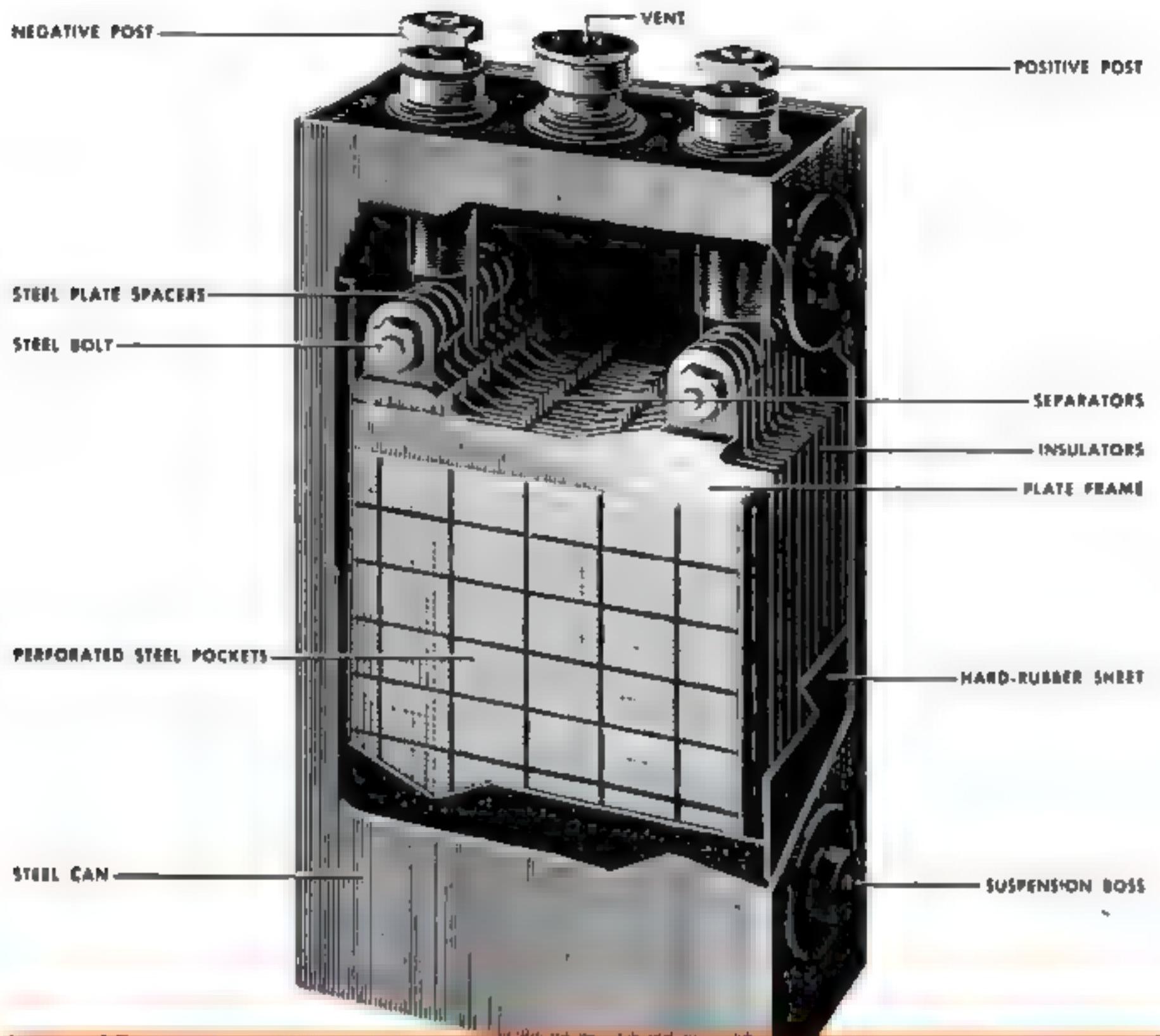
Tiny Pencil Clips Tie

LESS than four inches long and only an eighth of an inch thick, this tiny mechanical lead pencil can be worn as a tie clasp. Made by the Stencil Co., of Orange, Mass., it has a long, spring-wire clip on the back that fastens the tie to the shirt. The lead is propelled or retracted by a single knurled roller recessed in a slot in the center of the pencil. The top, taken out and reversed, provides a convenient eraser.



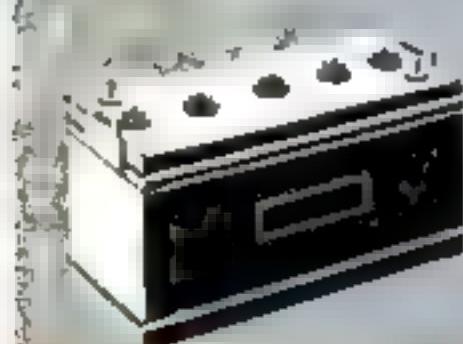
Electric Shoe Shiner

WANT an easy shoe shine? The Groomaster® will meet you half way. Just put on the polish, slip your foot under the whirling buffer, and this portable home shoe-shining machine will do the rest. The eight-inch electric sheepskin buffer works the wax in and polishes at the same time. If placed near the front door, it can also be used as a handy shoe cleaner for entering feet. On top are places for three jars of wax.



ADVANTAGES OF NICKEL-CADMIUM BATTERY OVER

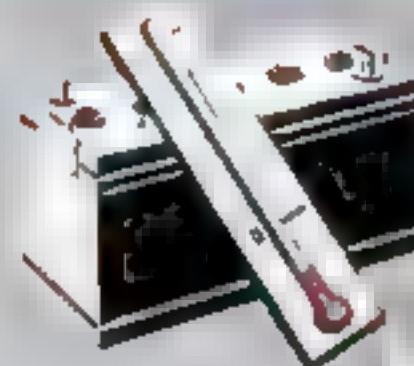
NICKEL-CADMIUM BATTERY



3 CELLS.
6 VOLTS

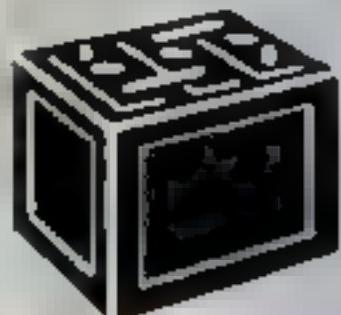


MOLDS CHARGE
WHEN IDLE



CANNOT FREEZE

LEAD-ACID BATTERY



3 CELLS. 6 VOLTS



DISCHARGES
WHEN IDLE



FREEZES IF LOW IN
SUB-ZERO WEATHER

Nickel-Cadmium Battery Lasts as Long as the Car

New to United States, this European juice box will not crack, freeze, spill acid, or run down when left idle.

By Harland Manchester

PS photos by W. F. Morris

ONE of the greatest headaches of the American driver is his automobile battery. If left untended in storage, it grows green whiskers and dies; if it gets low in sub-zero weather, it is liable to freeze and crack. Jolting on rough roads may break its hard-rubber case, and without frequent drinks of water it ceases to function. Even with careful nursing and no mishaps, it

often has to be replaced several times during the life of a car.

Yet there is a battery, new to the United States, that has none of these failings. It will not crack or freeze. Put it away all winter, and it holds its charge and does not deteriorate. Equipped with this juice maker, you wouldn't buy a new battery for your car—you would buy a new car for your battery, for it will last 15 or 20 years.

Ask your service man about the nickel-cadmium battery and he'll tell you he never heard of it. Look in American textbooks and you won't find it. Yet this superior battery has been used all over Europe for nearly 40 years.

Possibly six Americans are using this

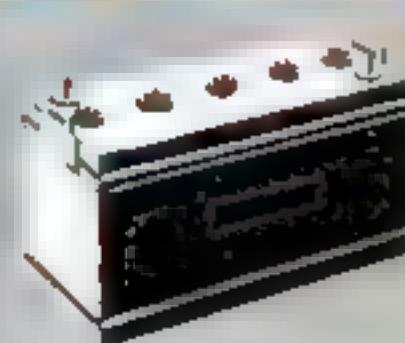
LEAD-ACID BATTERY NOW USED IN AUTOMOBILES



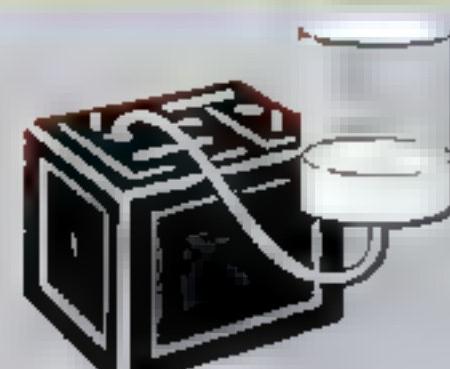
Goes 8,000 miles
on one drink



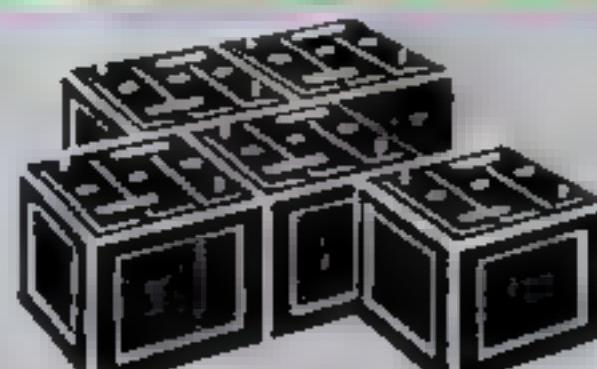
One battery lasts 1½ to 3 years



Alkaline electrolyte
permits use of un-
breakable steel case



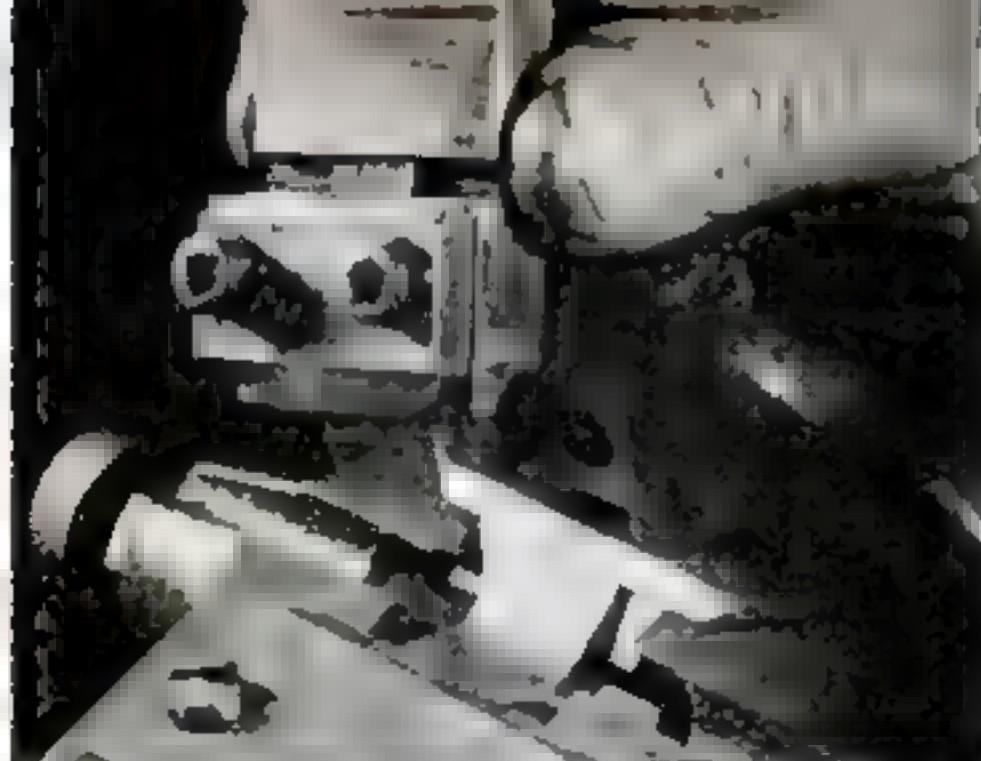
Needs water
every 1,000 miles



Each battery lasts
1½ to 3 years



Acid makes breakable
hard rubber case
necessary



First step in making nickel-cadmium battery is perforation of long strips of steel tape by these needles in the head of a mechanical hammer.



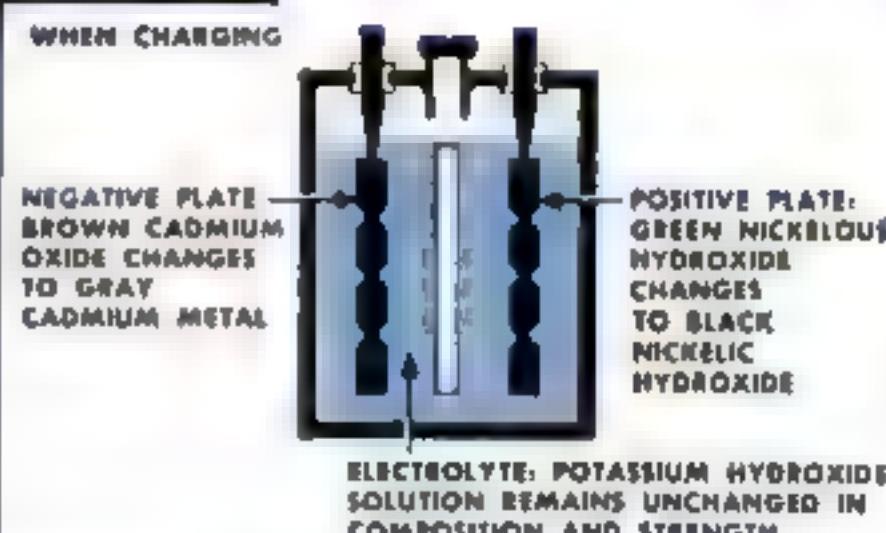
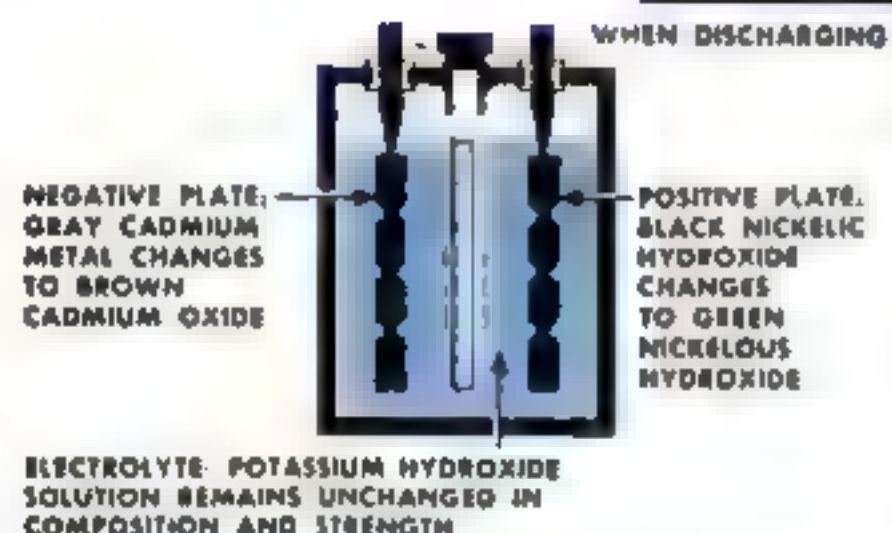
Tape then is flanged to form trough with tiny holes in bottom. Pictures were taken in first U. S. production plant at Easthampton, Mass.

battery today in automobiles and boats. A New York businessman put one in his Chrysler 18 months ago and has run it 40,000 miles without adding water, leaving his car outside on sub-zero nights. It is still full of life. A Rochester man put these batteries in his Diesel-powered fishing boat and laid it up for nine months without attention. Last January he stepped on the starter, and the engines roared.

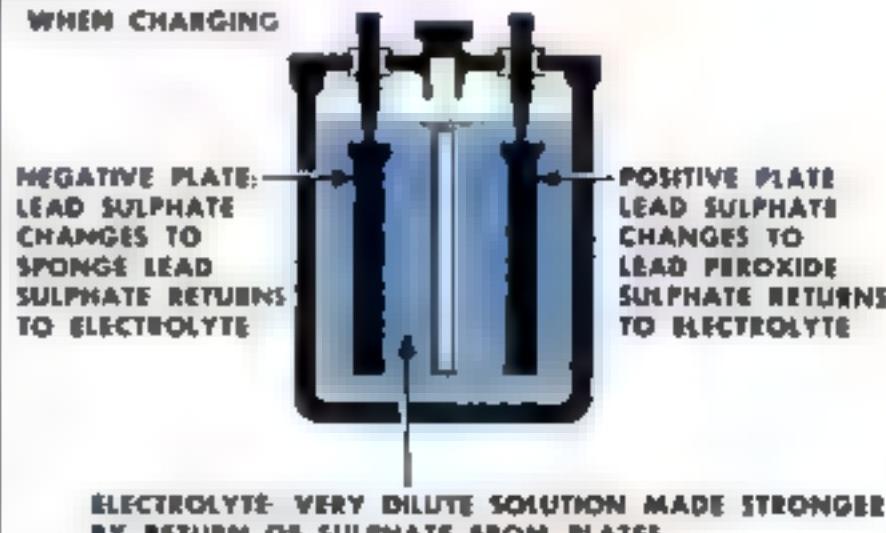
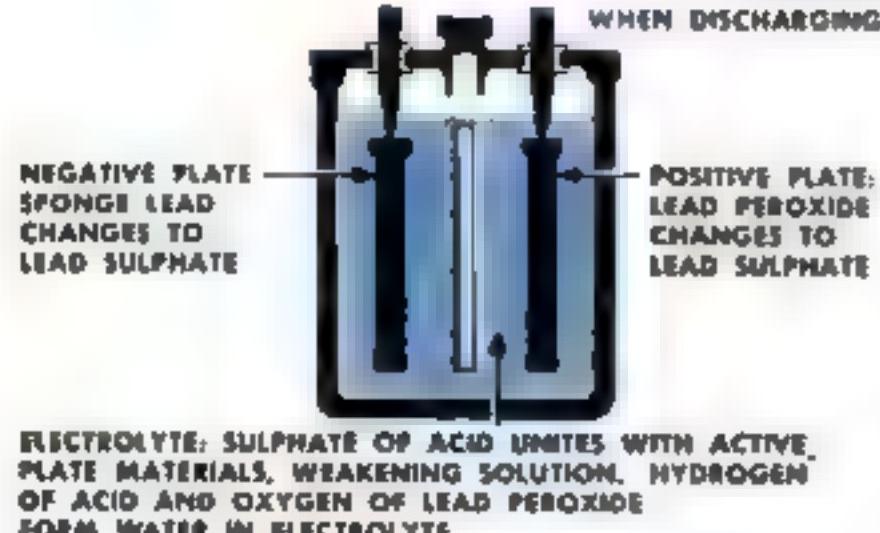
Novel as this may be to Americans, it is

old stuff in Europe. The nickel-cadmium battery was first produced in Sweden in 1909, and since then its manufacture has extended to England, France, Germany, Russia, and a dozen other European countries. It is used in thousands of buses, railway cars, Diesel locomotives, switch yards, signal systems, air-conditioning plants, utility systems, yachts and liners, and in small portable electric lamps. It was one of the refinements installed in the *Queen Eliza-*

NICKEL-CADMIUM BATTERY



LEAD-ACID BATTERY





Active material of battery is pressed into trough. Positive plates get nickel hydroxide and graphite; negative plates, cadmium oxide and iron.

beth, the *Queen Mary*, and the *Normandie* as an emergency power source to run lights and various devices. During World War II the Germans used this battery in the V-2 rocket, and it supplied reliable starting and easy maintenance for planes, tanks, trucks, submarines, and other fighting equipment in all occidental armed forces—save those of the United States. Americans not only haven't been able to buy the battery, they have remained in almost complete ignorance of its existence.

At long last, the wall of silence has been broken down, and the better battery is actually being manufactured in a plant in Easthampton, Mass. During the war, American experts on the hunt for more efficient equipment had a chance to see the battery, and test its superiorities over the lead-acid battery commonly used in the United States. One of these experts, Lt. Col. H. B. Nichols, a West Pointer of the Air Materiel Command, determined to introduce it in this country. As soon as he took off his uniform, he secured the services of Carl Berg, son of the battery's co-inventor and one of the world's leading engineers in the field. He then formed a company and set up a small factory. During the last year, his firm, the Nickel Cadmium Battery Corporation, has turned out batteries in sizes ranging from a tiny model suitable for a hearing aid to giant multiple units that will start a Diesel locomotive. He has not yet entered the automobile field, but has sold about 2,000 of the new batteries to railroads, utility firms, oil companies, bus fleets, and other industrial users, and his files bulge with orders and inquiries from all over the country.

The virtues of this battery stem from

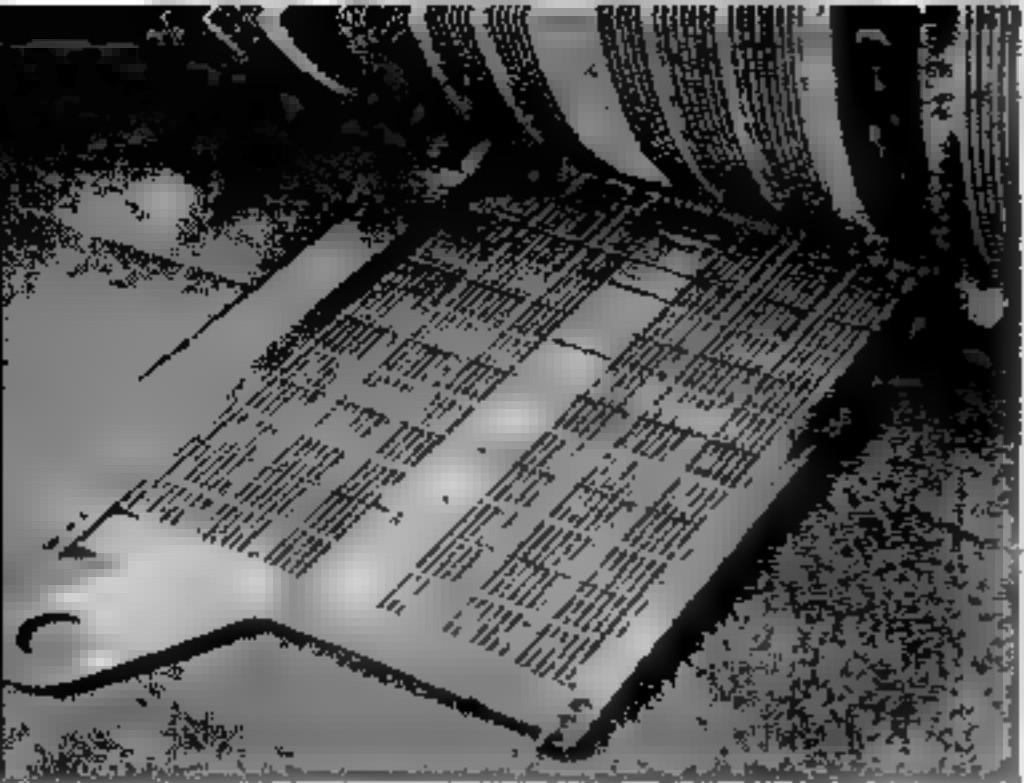


Trough packed with powdered oxides now has section of perforated tape clamped over it to hold chemicals but admit battery fluid through holes.

chemical and mechanical properties radically different from those of the hard-rubber-cased ones familiar to Americans. The latter yield electric energy by the chemical action of a sulphuric acid solution on a series of lead and lead-oxide plates; while the new battery delivers juice through a chemical change in plates of cadmium and nickel hydroxide, using a solution of strong alkali as virtually nothing more than a conductor of electricity. The chemical difference accounts for its long life and the fact that it can be stored without deteriorating. And because an alkaline liquid is used, it can be housed in an unbreakable steel container, which acid would eat through.

How It Was Born

The story of this battery goes back to two ingenious young Swedes, Waldemar Jungner and Karl Ludvig Berg, who finished technical school about 1889 and looked about for something to invent. Berg, a mechanical genius who worked for Jungner's wealthy uncle, a cereal manufacturer, had already built machinery for processing rolled oats. It was a dry summer of many fires, and Jungner designed a battery-operated fire-detection device called a "pyrophone," which rang a warning bell when fire heated thermocouples in the form of wires strung around the ceiling. The device got publicity, and orders poured in that swamped the manufacturing force, composed of Jungner, Berg, and Jungner's two sisters. Then angry complaints came in that the pyrophone wasn't working. They investigated and found that the dry-cell batteries were dead. They quickly decided that to save the business they had to invent a new battery that would hold a charge during a



Stripped together and held in frame, trough units form plate. This is now corrugated cross-wise by roller press (above) to add strength.

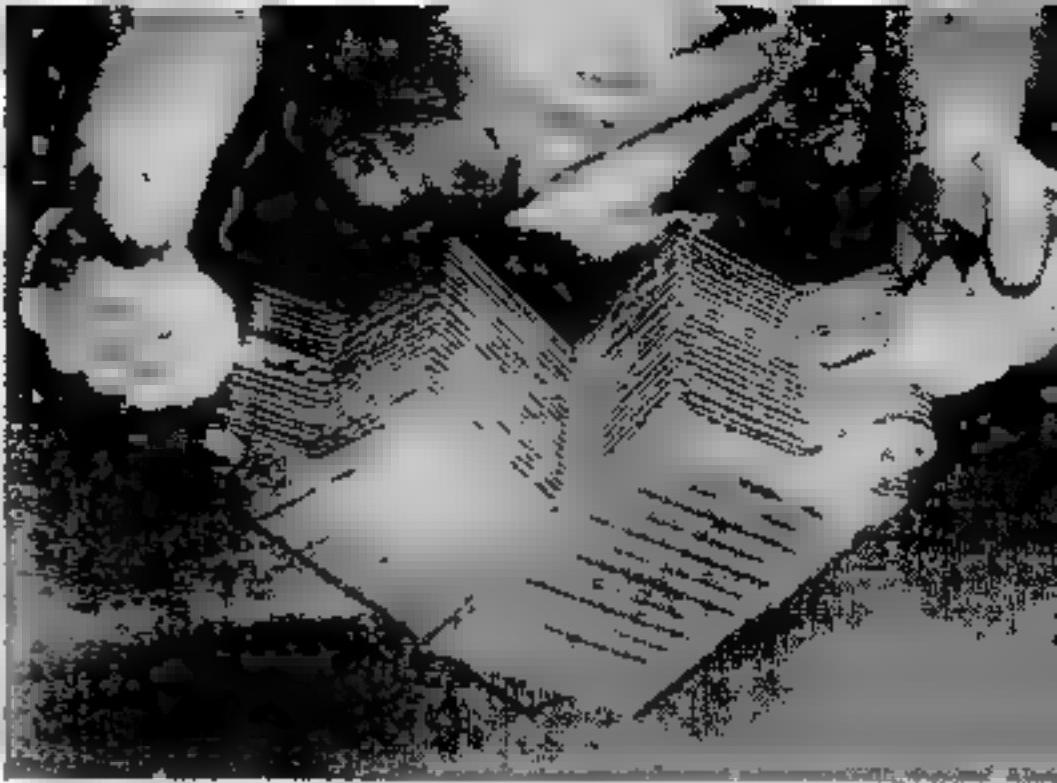
long idle period and, while they were about it, that they would work out a new storage battery instead of trying to improve the dry cell. So with Jungner as the chemical expert and Berg the physicist, they tested all manner of metals and chemicals that could possibly be used in the electrochemical storage of power. They saw no hope of getting the long life they desired from an acid battery, and tested metals that would work with an alkaline solution. They settled temporarily on nickel and iron, and in 1899 Jungner took out a Swedish patent covering all alkaline batteries.

One Step Beyond Edison

At the same time, Thomas Edison was working on the same problem, and at the turn of the century began to make a similar battery. Both batteries gave trouble, and both manufacturers halted production to do more research. Edison corrected the trouble, and continued to make the nickel-iron battery, which is well suited to a number of uses. But the Swedish firm shifted from iron to cadmium, a soft, gray metal obtained mainly as a by-product of the processing of zinc, and in 1909 began to turn out this completely new battery, superior in many ways to all other batteries on the market.

By the end of the next decade, four firms, in Sweden, England, France, and Germany, were making nickel-cadmium batteries under various licensing agreements, and assembly plants in other European countries were making everything but the active chemical material, which the "master companies" made by secret formula and shipped in drums.

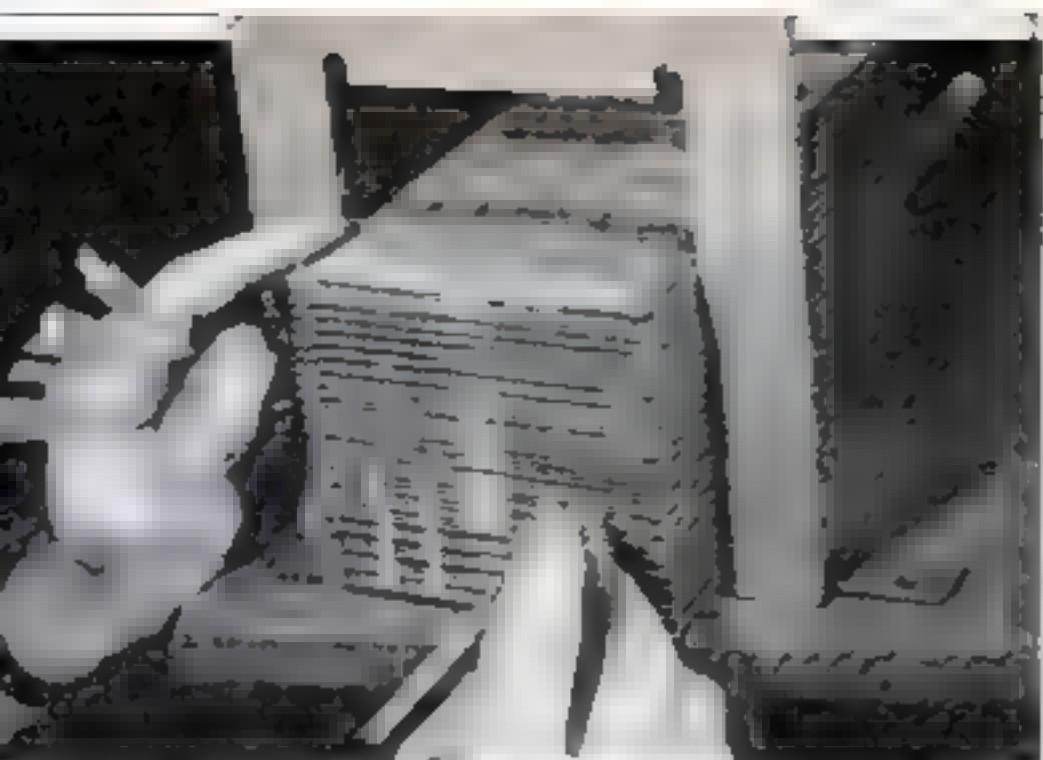
As time went on, bus fleets and railroads reported that the batteries they had bought



Assembled sheaves of positive and negative plates are intermeshed. Two prongs held by workman are opposing terminals of the battery.

10 and 15 years before were as good as new. A cadmium battery installed in a Diesel rail car in Sweden in 1913 was still in use at the latest report, after starting the engine 300,000 times. The battery became popular in motorcycles because it stood up under heavy vibrations. Many business and professional men and automobile fanciers installed it in their cars, although the price was about twice that of a comparable lead battery.

The new rival caused anxiety among the makers of lead batteries, which have a normal life of one and a half to three years. Until last year, when a suit for violation of the Sherman Antitrust Act broke up the cartel, the world's three major manufacturers of lead batteries cooperated closely. These are: the Electric Storage Battery Company, of Philadelphia (100 percent owner of the Willard Storage Battery Company, of Cleveland, and Exide Batteries of Canada, Ltd.); Chloride Electric Storage Company, Ltd., of London; and Accumulatoren-Fabrik Aktiengesellschaft (AFA), of Berlin. Following conventional cartel practice, these firms had for several decades exchanged patents and secrets, allocated sales territories, and fixed prices of their products throughout the world. Early in the '20s, members of this group began to acquire holdings in the cadmium battery firms, and by 1936 the cartel had established sufficient control and influence over its rival to direct policy. Prices of cadmium batteries were then artificially pegged at about three times those of lead, but that did not deter buyers. Users in Mexico, Brazil, Argentina, Chile, Uruguay, India, Malay, Siam, and South Africa enjoyed its advantages, and it penetrated even to remote regions in Afghanistan and Tibet,



Separators of polystyrene, a nonconducting plastic, are inserted between the plates so that alkaline battery fluid can get between them.

while it was not available in Canada and the United States.

By this time the original Jungner patents had expired, and there was nothing to keep an independent American manufacturer from making the battery—except lack of technical information, as well as complete ignorance of its existence. Curious visitors have been barred from the plants. The *Encyclopedia Britannica* devotes eight pages to the lead-acid and the Edison batteries, but does not mention the widely used cadmium battery. Twenty leading physics books used today in American high schools and colleges all describe the lead battery, but not one of them mentions the nickel-cadmium type. Out of 18 "up-to-date" textbooks on electrical engineering used in our technical schools, only one contains a single line about this battery. This means that few technical men trained in the United States have ever heard except by accident of this superior battery with which European and Russian engineers have long been familiar.

Inventor's Son Comes to U. S.

When the cadmium battery companies became a virtual appendage of an international cartel that thrived on its vast replacement market, many zealous engineers chafed under the new restrictions. One of them was Carl Berg, then chief engineer of Alklum Storage Batteries, Ltd., of England. In 1938 he left his job and came to the United States, bringing with him his brother Marcus, the firm's production manager. The Bergs' contracts, like others in the cadmium-battery field, stipulated that if they should leave Alklum they should not engage in manufacture of the battery for five years. Berg found this clause to be unenforceable

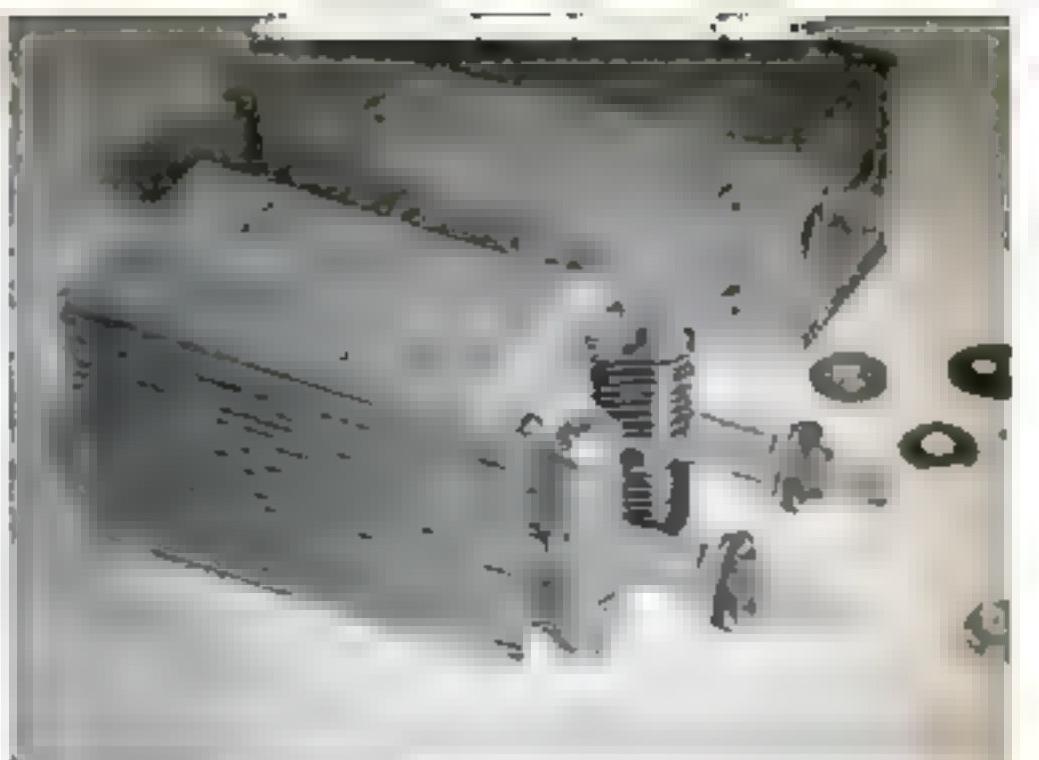


Plate group is shown alongside its steel case. Together, they form finished nickel-cadmium battery cell with a 360 ampere-hour capacity.

legally, and sought backers in this country.

Under Berg's direction, faithful copies of the ingenious machines designed by his father over a period of 20 years were set up in the Easthampton plant. Lengths of narrow, perforated steel tape are clamped together, forming pockets to hold the active chemicals, and the thin pockets are combined to make battery plates, which are installed in durable cases of nickelized steel. Shopping for the special steel tape, Berg was able to buy a consignment of 108 tons, tailored precisely for nickel-cadmium batteries, that had been manufactured here for shipment to Russia under Lend Lease and left behind on a Brooklyn dock. Using parts made in America, Russia is reported to have four factories turning out the batteries we haven't been able to get.

Oil companies were among the first customers. Used in starting engines that drive the oil-field pumps, many lead batteries last a few months—cadmium batteries have been used a year and a half and show no signs of deterioration. They are used in the urban buses of the Springfield Street Railway Co., and in the intercity Diesel buses of Trailways of New England. William Corriveau, Trailways maintenance engineer, reports that his lead batteries need water every 1,000 miles, while his cadmium batteries go 8,000 miles without a drink. Other users are the Southern New England Telephone Company, which has installed them in its new Yale private exchange in New Haven; the Boston and Maine Railroad, which uses them for signalling and crossing-gate equipment; the Pennsylvania Railroad, which has installed them for car air conditioning and Diesel-engine starting; and the New England Power Association, which uses them

for tripping switches in its installations.

Of great interest to the consumer are the tiny cadmium batteries suitable for flashlights, portable radios, and hearing aids. In 1912 the Russians equipped cavalry units with rechargeable cadmium-battery hand lamps for use in making camp. For many years, British miners and policemen have been using similar lamps, which burn for about ten hours on one charge, sell for about \$12, and last indefinitely. An engineer in New Jersey has an attractive palm-size cadmium-battery flashlight that he obtained from a German officer after the war. He has used it now and then for two and a half years, and has had it recharged twice. It would be simple to market such a flashlight with a small converter-transformer unit for home recharging.

Like many makers of new equipment, the Easthampton firm's first interest lies in the lucrative industrial market. It is concentrating on batteries for Diesel-engine starting, railroad switching and signalling, car lighting and air conditioning, and for the job the battery was invented for, running fire-detection systems. Plans for entering the automobile field are indefinite, although two car manufacturers are interested. The company is working on a completely new type of nickel-cadmium battery particularly suitable for use in automobiles. The method consists of stamping the battery plates out of powdered nickel and baking them like a batch of cookies. This trick of stamping machine parts in molds from metal powders

and baking, or "sintering," them was one of the most dramatic factory developments of the recent war (PS, April '41, p. 98; June, '43, p. 98). It was used to make durable, highly porous tank and machine bearings that soaked up oil like blotters and were permanently self-lubricating. During the war the Germans tried to make battery plates in this manner, but the work was sabotaged by slave labor. Now Andy Langhammer, head of the Chrysler Corporation's Amplex Division and one of the world's leading experts in the powder-metallurgy field, is working with the Easthampton people to make tough thin nickel plates that look solid but, because of invisible pores, are actually 80% air. These plates are impregnated with the necessary chemicals to make the battery lighter and smaller and to speed up production and reduce labor costs. This sintered-plate battery is now being made in laboratory quantities, and there is plenty of work to do before it is ready for production. When it comes, it may replace one of the most troublesome parts of today's automobile. If it were sold only as optional equipment, many drivers would pay a higher price for the relief it would bring.

Signal Corps Trying It

Other American groups are working on the cadmium battery. Baker and Company, Inc., of Newark, N. J., has employed Dr. Anna Hauel, German expert, and is preparing to manufacture it. The U. S. Signal Corps is experimenting with the battery to determine its most effective war uses. Among its military advantages: it can be stockpiled, unlike lead batteries, without attention; it emits no corrosive fumes; and it is so crashproof that it has survived train and airplane wrecks.

But the nickel-cadmium battery will not supplant all other batteries. The lead battery and the dry cell will always be cheaper and satisfactory for many jobs, and the Edison battery has its own field. Experts say that the cadmium battery is not suitable for electric trucks, in which the storage battery is discharged every day and recharged at night. But, as Europe has shown, it is a superfine tool of many applications, and our government is losing no time in repairing its dangerous ignorance.

America may be 40 years and two wars late in getting this new tool, but her unquestioned genius in production should soon outstrip the world in putting it to work. END



Widely used in Europe, as these pamphlets indicate, the nickel-cadmium battery—Invented in 1909—was long kept off the American market.



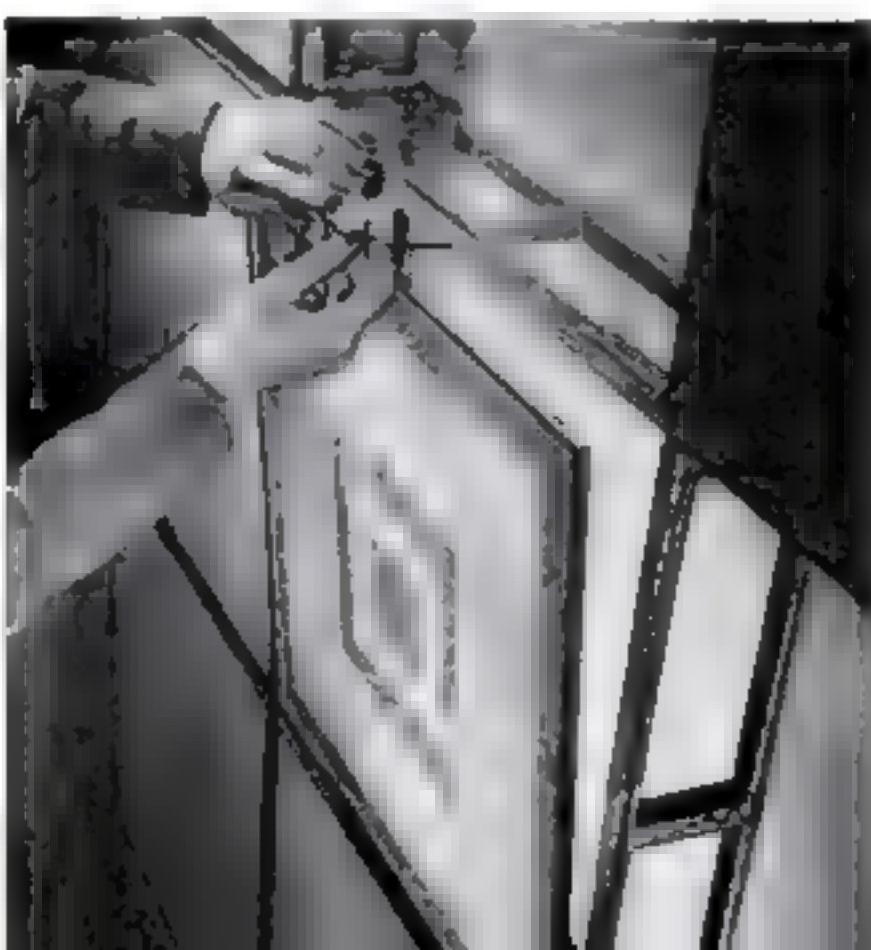
Giant Press Bales Autos

This gigantic hydraulic press takes whole auto bodies and in one motion crushes them into neat, bite-size morsels for the scrap-hungry mouths of southern California steel furnaces. Designed to speed the salvage of scrap metal, the huge crusher (above) is six feet wide, five feet deep, and 16½ feet long. It weighs 250 tons and is sunk 30 feet into the ground. Five hydraulic rams inside the press put a 500-ton squeeze on the car bodies and similar-size gulps of scrap and crunch them into small bales measuring 24 x 24 x 56 inches, as can be seen in the foreground above. Recently installed at the A-1 Iron and Metal Company, of South Gate, Calif., the press keeps two clamshell bucket cranes busy feeding it scrap from a five-acre pile. Construction of the giant took two years and cost \$100,000.



Glass Blocks Form Wall

ENTIRE walls or partitions of glass can be easily assembled by simply fitting together these interlocking, double-pane blocks. Called Temprex Duo-Pane®, they each consist of two 20-inch-square panes mounted 3½ inches apart on a structural aluminum frame. One pane is fixed, the other removable, permitting certain sections to hold knickknack shelves. The glass is five times stronger than ordinary glass and comes clear, diffused, or patterned. Lighting units can be installed inside the wall.





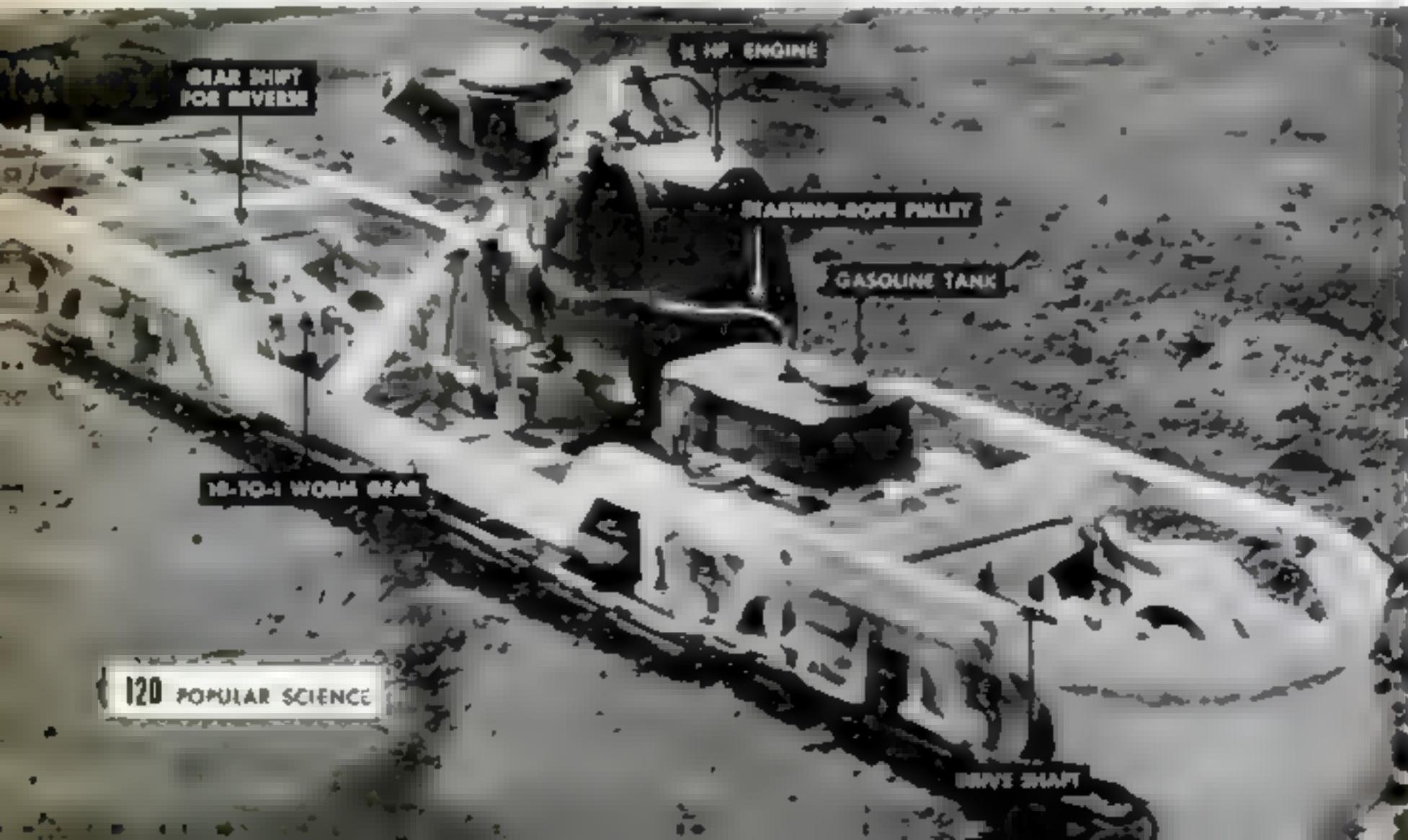
Train's designer, Hawley Bowlus, poses with locomotive and three of its five cars in back

yard of his home at San Fernando, Calif., where it's the envy of boys from miles around



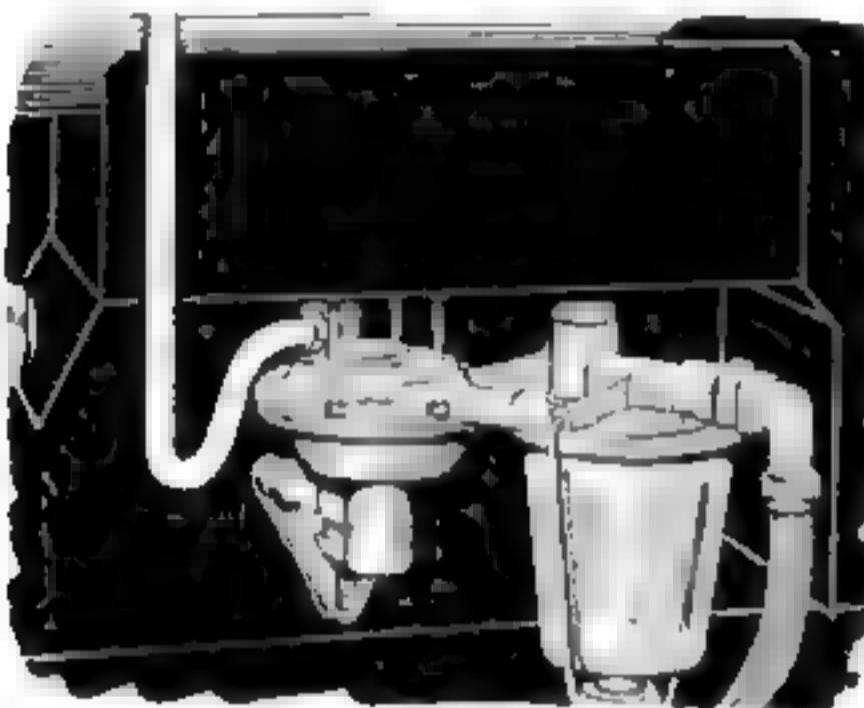
Two boys can ride in each car. Bowlus's son Jack (left), sitting nearest the locomotive but riding backwards, serves as engineer. His brother Charles, facing ahead, is the pilot

Gasoline engine on front section of locomotive (below) also powers wheels of its rear section.



I'd like to see them make . . .

Everybody has his own pet idea of some gadget he would like to see in general use. What is YOUR? Popular Science will pay \$5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



Transparent fuel lines. A clear plastic tube from the pump to the carburetor, preferably with a spinner or streamer inside, would help in troubleshooting auto-engine difficulties.—M. D. Hernandez, Oxnard, Calif.



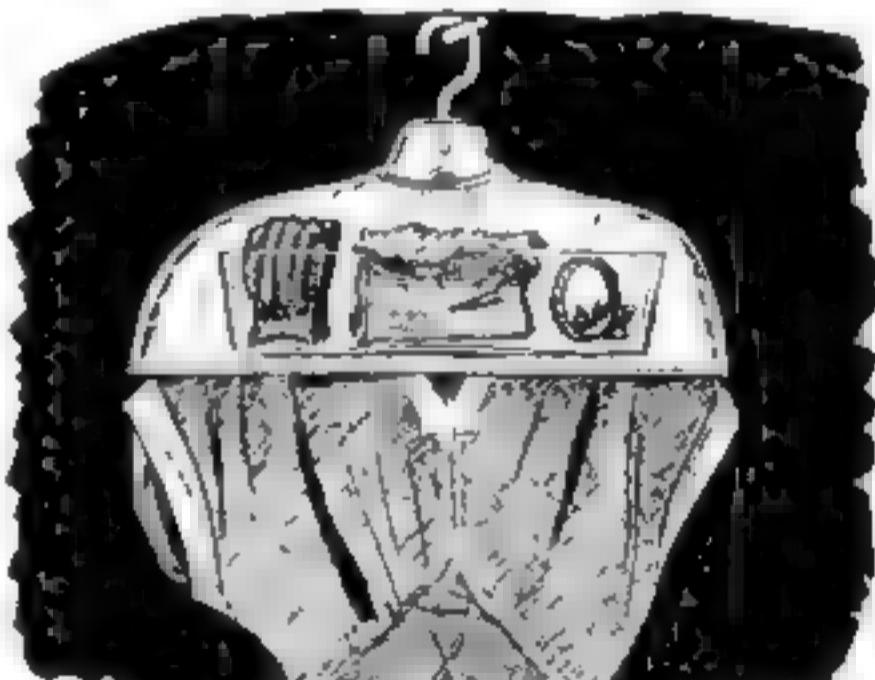
Timer for fans. A time-delay switch would be a boon when you wanted to go to sleep with the fan on but didn't want it to run all night. Just set it to shut off at a certain hour.—Herbert Broome, Jr., Columbia, S. C.



Safety lighters. A dashboard cigarette lighter—the wireless type—that has the hot element at the end of a cone would let the driver keep his eyes on the road when using it.—Bradley S. Hart, Rutland, Vt.



A nursery camera. Baby-safe lighting, a preset fast lens, and remote control to let Pop click the shutter, would give parents a photo of new offspring. Fees could go to the hospital.—E. N. Dambacher, Jr., North Hollywood, Calif.



Accessory holders. A shoulder cover for each dress with pockets to hold gloves, belt, jewelry, scarf—all accessories for that particular outfit—would be a time-saver.—Mrs. J. C. Dorrah, McPherson, Kan.

HOW FIT ARE YOU?

EYE AM

WEIGHT

RESPIRATION

NOW WT

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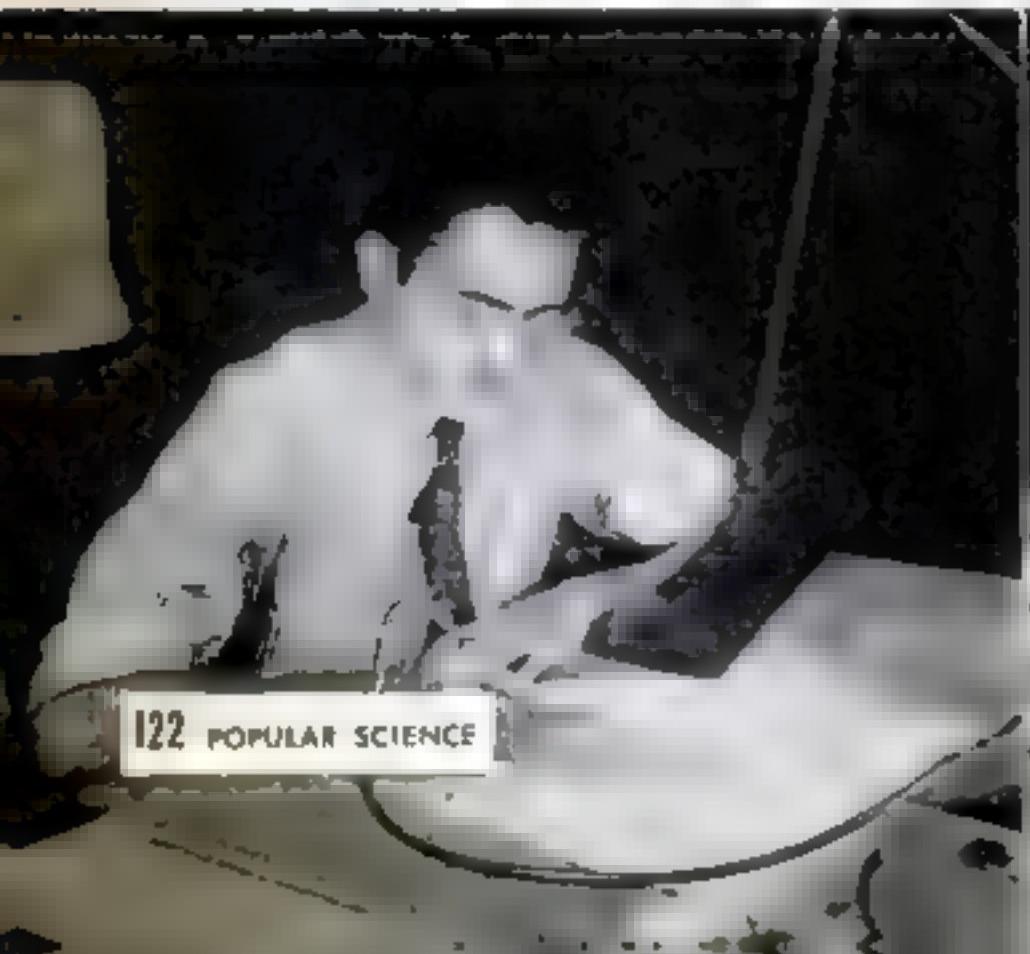


Visitors to the Health Museum can check their weight and height, test their eyesight, and measure their lung capacity by turning a dial,

In Museum shop, an art student-craftsman uses burr to etch "bone texture" into a piece of plastic. When finished, it will be the "bone" part of hinge tooth shown assembled on opposite page.

they can also learn their estimated remaining life span. Other exhibits show circulatory system, food values, how to handle heavy objects.

Even electric commutator drums, which turn the lights in the transparent tooth on and off in the proper sequence, are built by Museum technicians. Nothing is bought that can be made



Self-Service Museum Puts Curiosity to Work



Super-craftsmen at a Cleveland museum are translating health into push buttons—and visitors do the pushing.

By George H. Waltz, Jr.

IN A small, well-equipped workshop just off one of Cleveland's busiest streets, carpenters, artists, and technicians are making health visible. Their shop is part of the famous Cleveland Health Museum. Their job is building unique exhibits for the public to play with—and learn with.

Since the Cleveland Health Museum is a "push-the-button-turn-the-crank" place where the visitors run the exhibits, its work-

Plywood frame for plastic tooth is carefully sanded so contours will exactly match those of giant fang. Two rectangular openings hold lighted legends of tooth parts shown in display

shoppers have to be ingenuous. They must tell the story of humans and how they tick, in terms of plaster, wood, metal, plastic, rubber, gears, motors, lights, and wiring. It is work that requires showmanship, medical know-how, and creative skill with tools and paintbrushes. These workshoppers have no ready-cut plans. They must dream up as well as build the exhibits.

They may be called upon to make anything from a realistic, giant-size plastic model of a tooth to a "calorie cafeteria" in which you can learn the energy values of various foods merely by pushing buttons. Their shop is a home craftsman's dream—fine tools and equipment, with every man on the staff an inventor and designer as well as a craftsman.

When the Cleveland Health Museum opened in 1940, it was the first of its kind in the country. Since then, with its exhibits and its reputation growing steadily, it has become a fountainhead—a sort of combination manufacturing plant and lending library—for a new kind of health and hygiene

Completed display demonstrates normal tooth construction. Lighted sections show progressively enamel, dentine, pulp, cementum, periodontal membrane, bone, root, crown, and gum.



display. Its craftsmen now devote much of their time to making duplicates of their own original exhibits, either for loan or for sale at cost to schools, county fairs, health organizations, and other museums. By popular demand, they have been forced into the mail-order museum business.

When I visited the workshop a few weeks ago, the men were busy duplicating six of the Museum's dental-health displays for use at the annual meeting of the Southern California State Dental Society. One of their biggest jobs, however, was building exhibits for a new health museum for Bogota, Colombia, S. A. When those displays were ready for shipment, they filled 23 large packing cases and weighed four tons!

Thanks to these craftsmen, the Museum is not a collection of historical relics or a chamber of horrors. It uses clever devices to get across its important story of man and his health. It is visual education at its best. Wherever possible, moving, tri-dimensional displays are used in place of the usual stationary exhibits. There isn't a single "Do Not Touch" sign in the entire building. Anyone can walk up and push buttons, twirl knobs, pull levers, and turn cranks—and the exhibits are built to take it. As a result, the more than 40,000 yearly visitors have as much fun learning about their health and bodies as they would have at

an amusement park—and it's all for free.

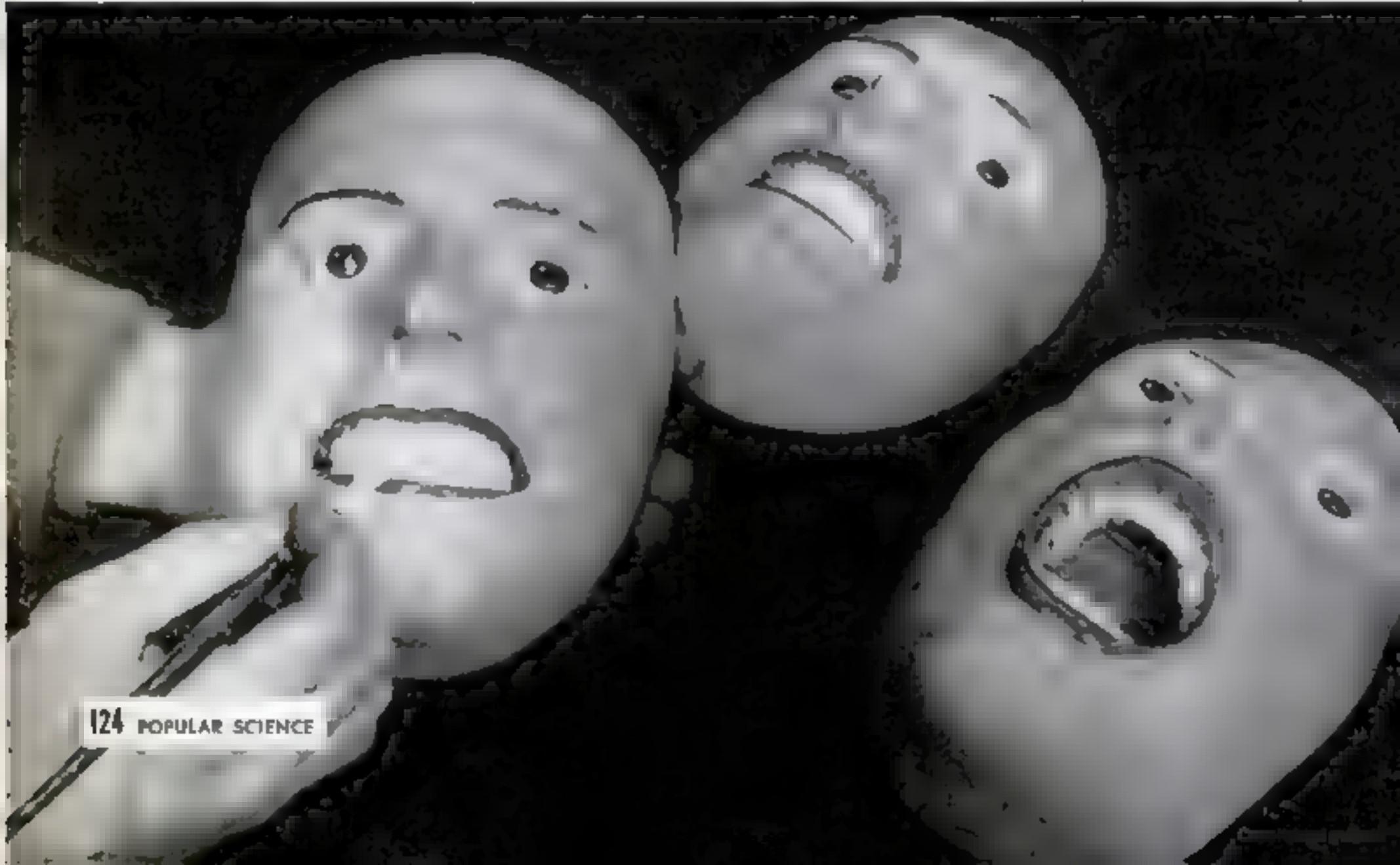
In spite of the lack of guard rails around the exhibits, the only item that disappears regularly is a ten-penny nail used to illustrate the iron in the human body. Incidentally, because of inflation and the rising costs of chemicals, the workshoppers have to bring this particular exhibit up to date quite frequently. In 1940, when the display was first built, the chemicals that make up the human body could be bought for 98 cents. Today, they are worth \$31.04!

Learning By Doing

The Cleveland Health Museum comes by its flair for educational showmanship quite naturally. Its director, Dr. Bruno Gebhard, is a pioneer in finding ways for people to learn by doing as well as seeing. After 10 years with the once famous German Hygiene Museum in Dresden, he came to this country in 1937 as consultant for all the medical and public-health exhibits at the 1937-1940 New York World's Fair. Then, in 1940, when a community-minded group of Clevelanders decided they wanted a different kind of health museum, they chose Dr. Gebhard for the job. That was in June. By November he had his museum in operation. "Most of the exhibits were either borrowed or of the 'five-and-ten-cent' variety," Dr. Gebhard says, as he looks back on it,

Lifelike facial masks for dental-health display are molded from plaster and painted. During

1947 alone, 670 such exhibits, films, and slides were duplicated for 109 other organizations.



Primitive Survival Lore

*Photos by Mike Ackerman
Acme Newspictures*

LAST fall, 15 men bailed out of a disabled B-17 over the dense wilderness of the Nicaraguan jungle. Search parties brought out 14, but the last survivor was so badly injured he couldn't be moved. Then a doctor of the USAF's Air Rescue Service, Capt. Polk Holliday, parachuted to his rescue. He nursed the man for two days until he was strong enough to be picked up by a helicopter. Today that man is alive and well.

Behind this dramatic rescue, only one of more than a hundred in the short, year-and-a-half history of the Air Rescue Service, is the story of a group of men whose sole job is the rescue of crash survivors, explorers, tourists, adventurous kids, and others who may be lost in remote places and require medical aid. The men work in teams of five: one doctor, two medical technicians, and two survival specialists. All are Army-trained jumpers. All are volunteers.

But before these men can help others, they must learn to help themselves. Combining modern science with primitive woodlore, they learn to take care of themselves in jungles, deserts, mountains, and on water.

Probably the toughest part of their eight-week training program is in jungle survival,

pictured on these pages. To start with, they jump five times into the Florida Everglades, actually trying to hit the treetops—just for practice—so they can learn how to let themselves safely down. Then comes intensive training in jungle housekeeping—how to protect themselves against insects, purify water, and build shelters of palm fronds. When they've finished this, together with training in desert, mountain, and sea rescues, they're ready for anything.

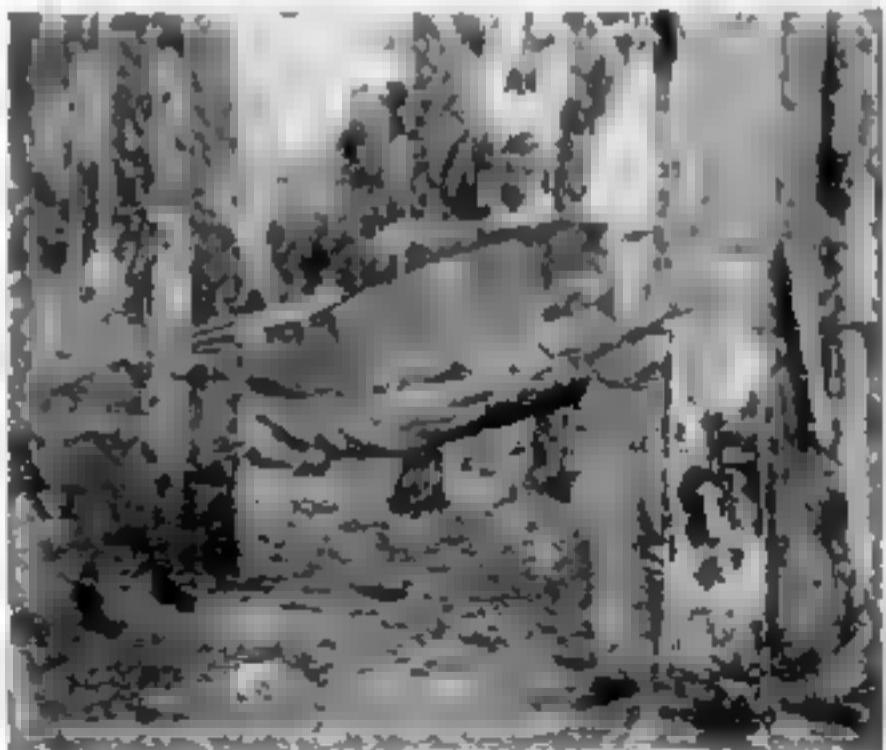
There are nine such pararescue units now in the U. S., and overseas units are located in Saudi Arabia, Libya, Bermuda, the Azores, Labrador, and Newfoundland.

The exploit the Air Rescue people are proudest of took place last winter in Labrador. On December 9th, a C-47 with 29 persons crashed only eight miles from Goose Bay. A ground rescue party set out on the 10th. The same day, Lt. Stanley Bear, a paradoctor, left Pope Field, N. C., by air for Goose Bay. On the 11th, a helicopter landed him on a frozen lake near the wreck. From there, he trekked to the plane, arriving three hours before the ground party.

Only six of the victims were alive, but all were evacuated by air and all survived. Lt. Bear had come all the way from North Carolina in less time than it took the ground party to travel about eight miles!



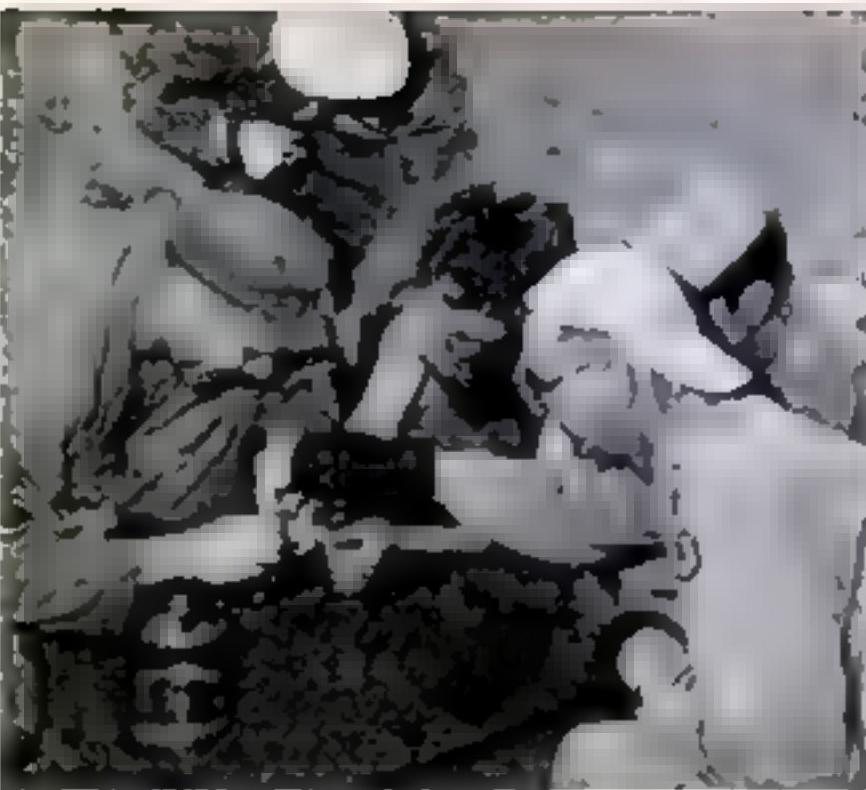
One of first jobs during jungle training is construction of a dispensary consisting of log framework covered with palm fronds. A cot for the dispensary will also be made of palm fronds.



All sleeping is done in tree-slung hammocks, as ground is often wet and swampy. This also offers best protection against prowling snakes. Awning over hammock helps keep sleeper dry.



Snakes are plentiful in the Everglades, so pararescue trainees must learn how to catch and kill them safely. Strapped to palm stems and baked, they make good eating—some say.



Head of dead water moccasin is nuked to remove poison from fangs. Note that medic in foreground is wearing gloves. The deadly poison is still active even though snake has been killed.



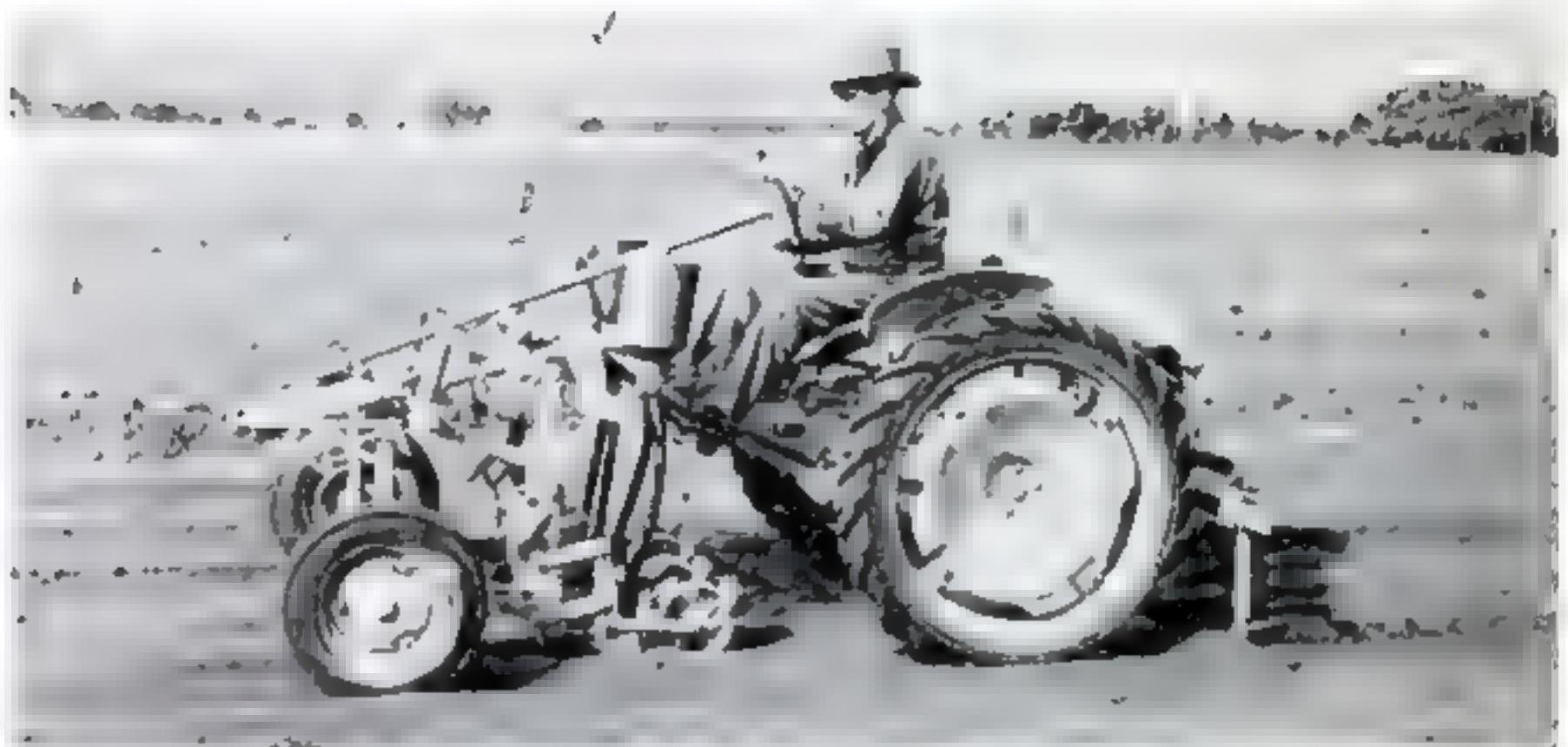
Cooking and eating utensils are fashioned out of bamboo. Hollow sections form natural drinking cups; split sections make scoops and ladles—but other items require more ingenuity.



Getting ready for a jump, a pararescuer climbs into an outfit designed especially for landings in dense jungle. Heavy suit, high collar, and helmet protect him against scratches from sharp branches. Rope at his waist will help lower him to the ground if he lands in a tree. Note large pocket on his right leg to hold the rope coil.



Moist and fire-resistant, bamboo utensils can actually be used to cook food or boil water over a fire. To save time and work, the men eat from the same utensils in which the food was cooked.



Tractor Has Rear Engine

ALLIS-CHALMERS has put the cart before the horse in this new farm tractor. Placing the engine behind the seat and mounting implements under the driver, between the front and rear wheels, give him a clear view of his work and make possible the precision tillage needed for truck farming.

For use with the tractor, called Model G①, the manufacturer has brought out a new line of cultivators and seeders. These

range from a single 12-inch moldboard plow to the multirow seeder shown above. Any of them can be hooked on in five minutes.

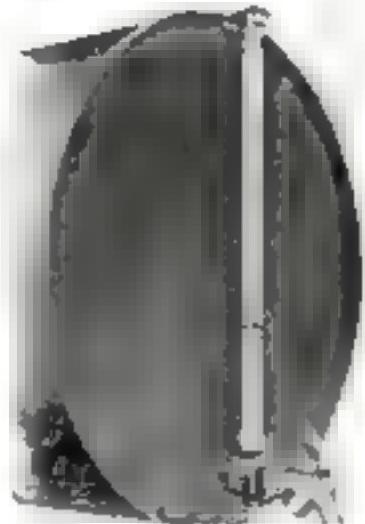
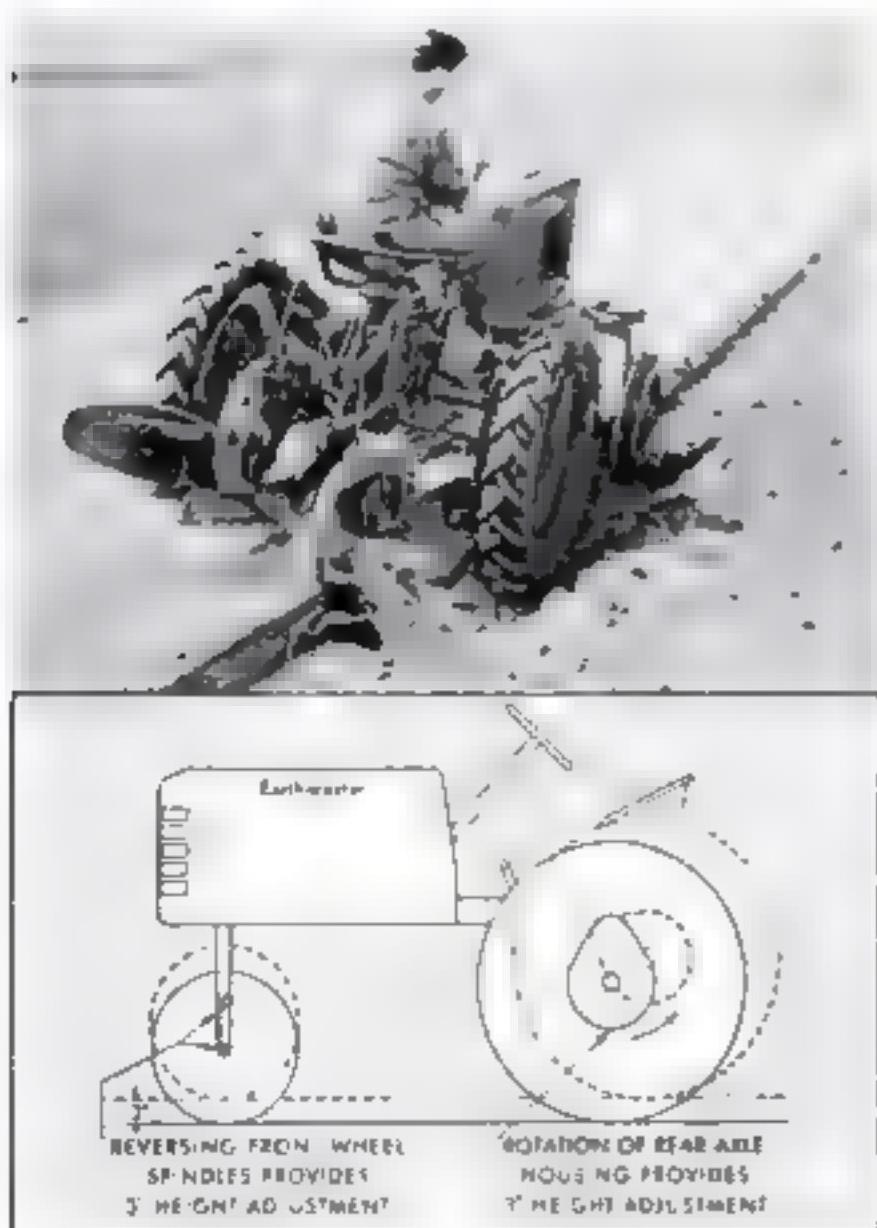
All controls except steering are behind the junction of the main trunk and the high-arching wishbone that carries the detachable implements. It would be possible, therefore, to disconnect the power and traction elements from the rest of the tractor and attach them as a driving unit to larger field machines. Steering then would be done by the tractor's individual-wheel brakes.

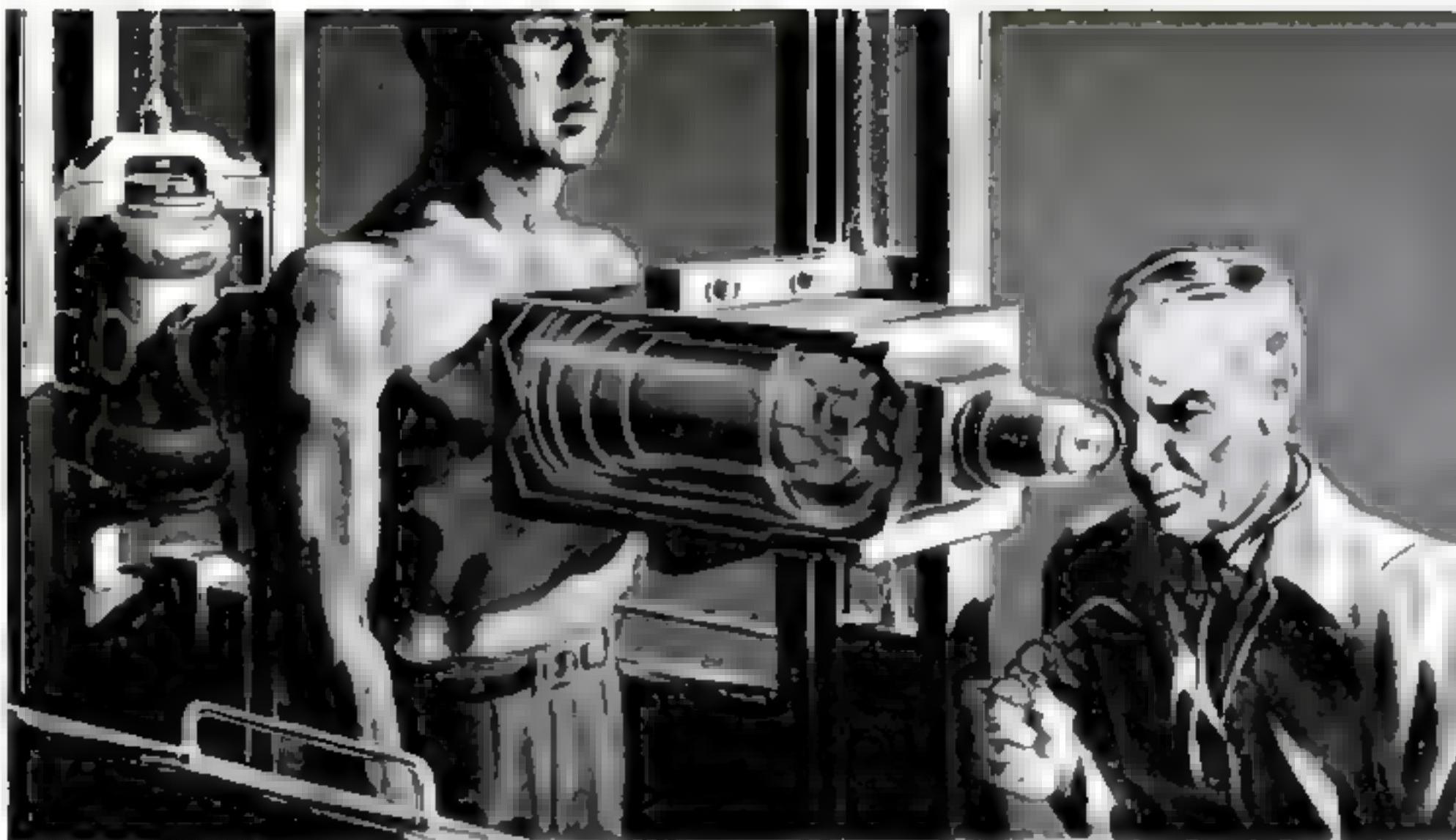
This One Carries Stilts

THE Earthmaster ① tractor at left can grow up with the crops it cultivates. Its ground clearance is increased from 18 to 21 inches by lowering the wheels in relation to the body. To do this, the front wheels are mounted on reversible spindles, while the axle housing of the rear wheels can be pivoted around the drive shaft for adjustment. Bigger tires can add another $3\frac{1}{2}$ inches.

Gauge Fits Oil Drum

THE Tru-Oil-Gage ① at right shows at a glance how much oil remains in a 55-gallon drum. The indicator is a cork floating in a plastic tube at the level of the oil in the drum. The top of gauge grips the drum's rim; the bottom screws into the head.





Doctor looking into electron fluoroscope has a brilliant view of patient's internal organs.

Electrons Now Brighten X Rays

WHEN a doctor gives you an X-ray examination with a conventional fluoroscope, he sees a dim, greenish-yellow-and-black image on the viewing screen. It is so faint that making out fine details of your internal organs in action is like trying to read a newspaper by moonlight. Soon, however, he can use a new X-ray viewer whose

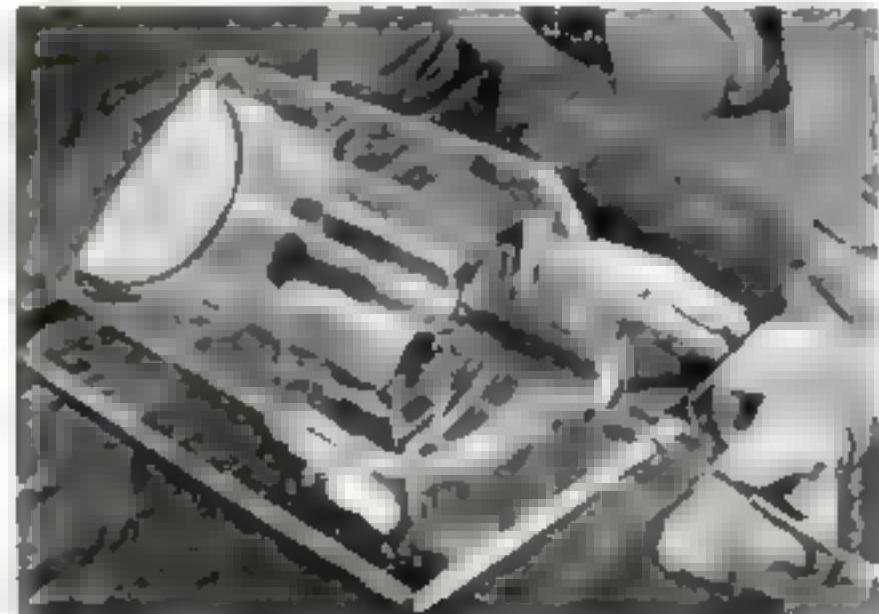
effect in brightening the image is comparable to turning a spotlight on the newspaper.

This instrument, which will amplify the brightness of the image 500 times, is an electron fluoroscope—a new electronic tube—developed by Westinghouse engineers.

With this enormous step-up in the brightness of fluoroscope views, faint clues to



Pioneer form of electron fluoroscope, above, proved the idea would work. It produced an image of five times the normal brightness upon the circular white screen at its nearer end.



Cutaway model shows latest type of instrument. Electrons from screen at far end, accelerated by 20,000-volt kick, give image 500 times as bright on small screen indicated at near end.

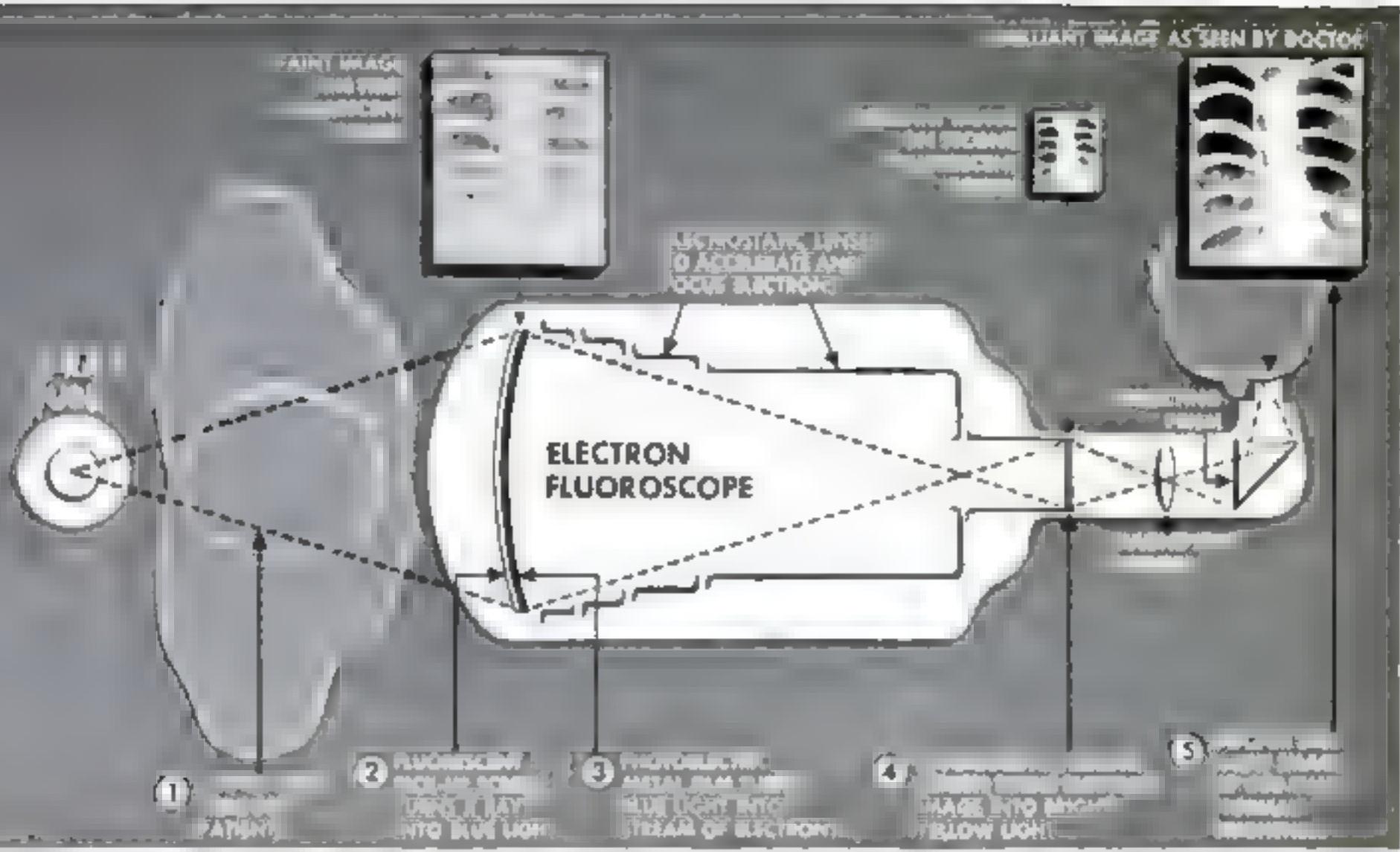


Diagram of the electron fluoroscope shows how it amplifies the brightness of an X-ray image.

disease—which formerly could be confirmed only by studying X-ray films—stand out prominently. In a few minutes of direct examination, a doctor may obtain as complete a picture as he could get from scores of X-ray pictures taken from various angles.

The principle applied by the electron fluoroscope is that used by the wartime "sniperscope" for seeing in the dark.

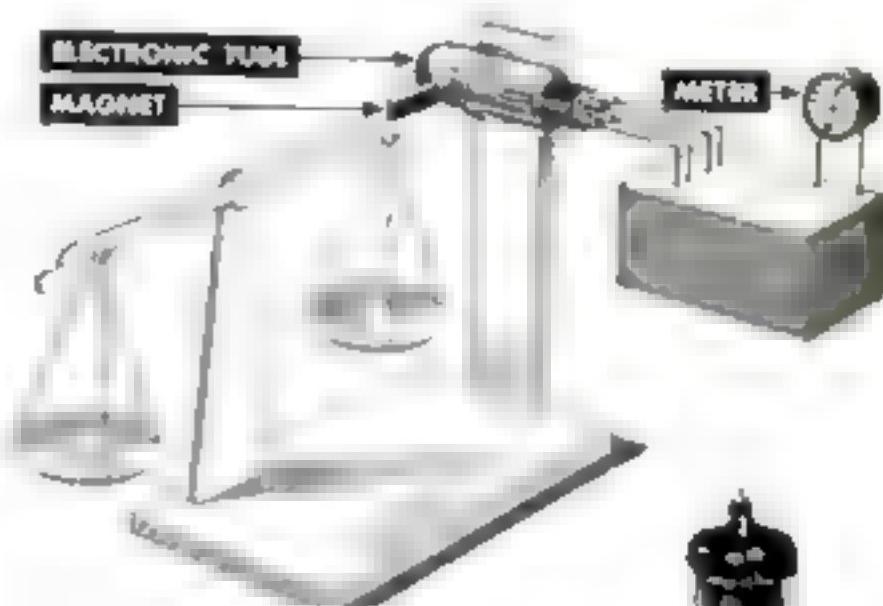
How it works is shown in the diagram above. An X-ray image is formed on the first of two fluorescent screens in the usual way, exposing the patient to no more than the usual amount of X rays. The back of

this first screen, however, is coated with a photo-sensitive film of cesium-antimony alloy. This gives off a pattern of electrons that conforms in shape and intensity to the fluorescent image. These electrons, accelerated by a 20,000-volt kick and focused by electrostatic lenses, then smash into a second fluorescent screen at 5,000 miles a second. There they produce a brilliant final image—even bright enough to be televised.

Thus the day may come when a doctor may call medical specialists hundreds of miles away into immediate consultation during his examination of a patient. END

Tube Detects Movement

A NEW electronic tube no bigger than a walnut can measure the slightest movement of objects as small as the hairspring of a watch. The object over which it "stands guard" must first be magnetized or have a magnet attached to it, as in the sketch at right. Any movement of the magnetic field then is detected by the change in its pull on a stream of electrons flowing through the tube. This change can be signaled either to a meter or to a motor that moves a second object to follow the first one. Eastman Kodak Co. developed the tube during the war to help aim antiaircraft guns.



Tube can tell when delicate scale is unbalanced by feeling the shift up or down of the pull of magnet on crossbar



"Traffic cop" along desert speedway sits in airplane seat on 12½-ft tripod. He has red signal light to warn drivers of impending mishaps.

BILL BURKE is an Alhambra, Calif., welder; Don Francisco, a city fireman. They're not sure just what their car is: it has the chassis and running gear of a Ford roadster, a Mercury engine, and a body made from the wing tank of a P-38 fighter plane. They put it together themselves, and in it Burke recently whizzed along a stretch of the Mojave Desert at 149.75 miles an hour.

That's the current record of the Southern California Timing Assn., at whose speed trials every week end some 250 hybrid jalopies like Burke's go screaming over the hard, smooth bed of El Mirage dry lake. It won't stand long if the drivers of these hot rods—as they're called—keep on thinking up new tricks to streamline a racing car and jazz up its engine.

Gunning the Hot Rods

By Andrew R. Boone

Many of the drivers are ex-GIs who learned how to doctor engines while repairing jeeps, tanks, and airplanes at bases around the world (PS, April '48, p. 134). In the last year they have added an average of about 10 m.p.h. to the top speeds of their patchwork racers.

To keep pace with their growing numbers and their steady push toward the 150-m.p.h. mark, the association has installed an elaborate speedway traffic system and an electronic timer that clocks the cars over a measured quarter-mile course to 1/1,000 of a second.

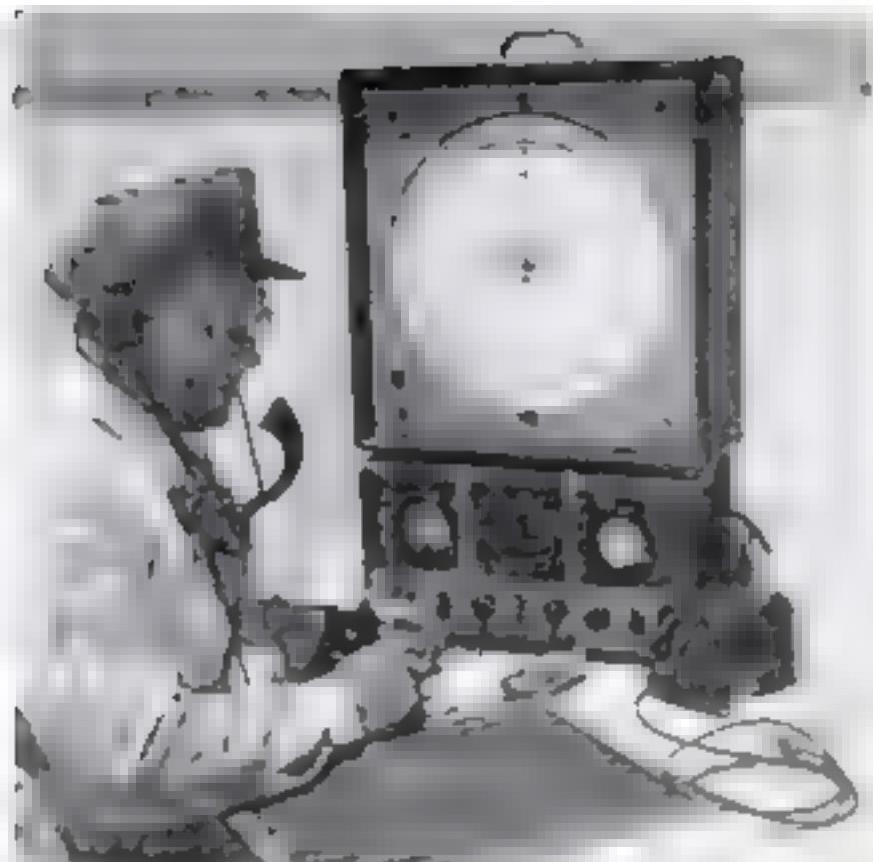
And after the hot rods hit 150?

"Up to 160—we hope," says Wally Parks, club secretary. He figures that dream may come true by 1950.

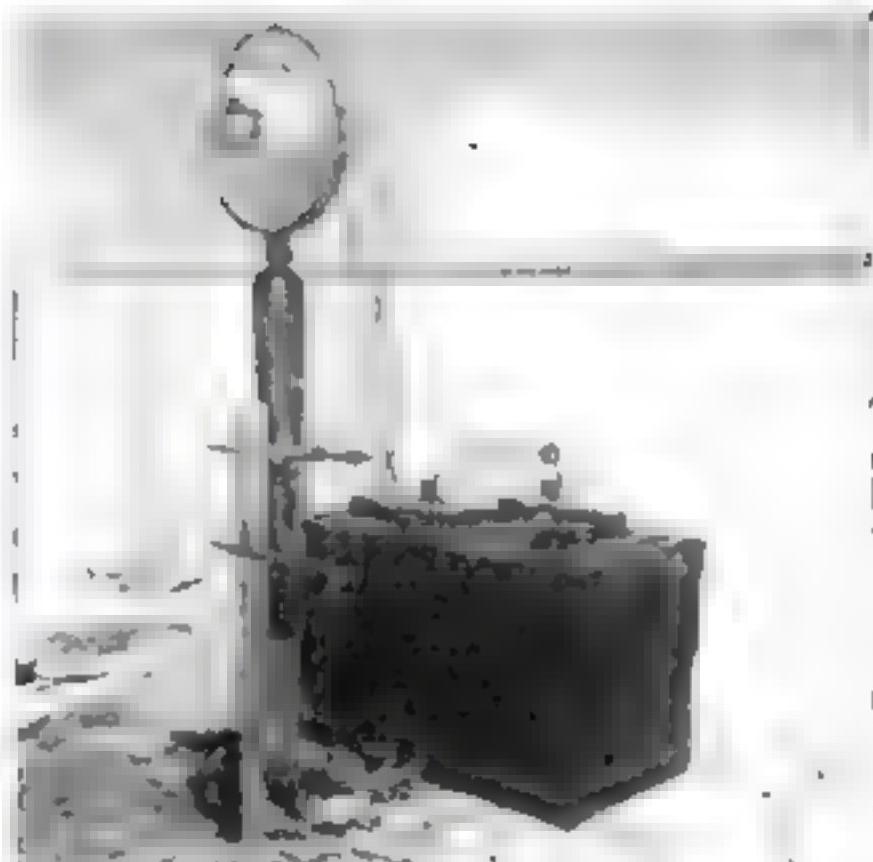


Starting lights flash red, amber, and green signals in succession to send cars out of three lanes at 20-second intervals on 1½-mile approach to their carefully timed runs through speed trap.

As many as 250 hot rods may make 500 starts on a week end. Starters get reports by phone from patrol judges and timers, and direct cars to the starting line by a loudspeaker system.



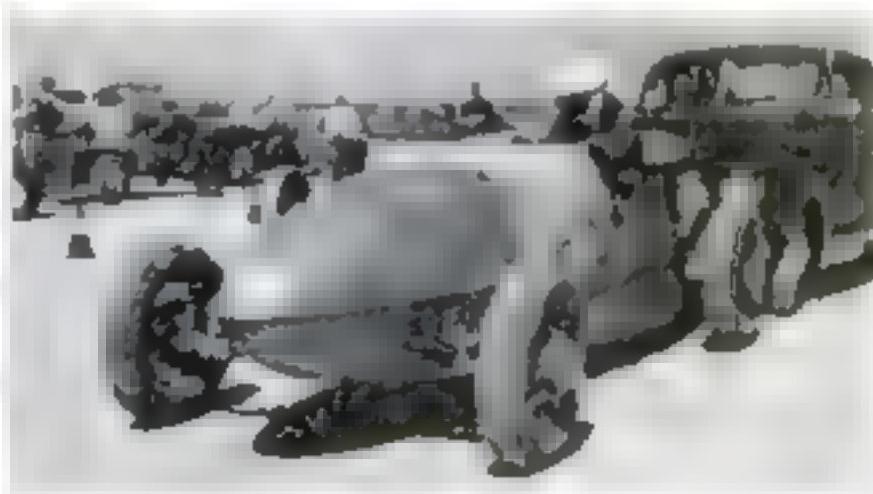
Electronic stop watch, calibrated to 1/1,000 of a second, times hot rods during speed runs. Shown with the apparatus is man who designed it, J. Otto Crocker, a San Diego bank technician.



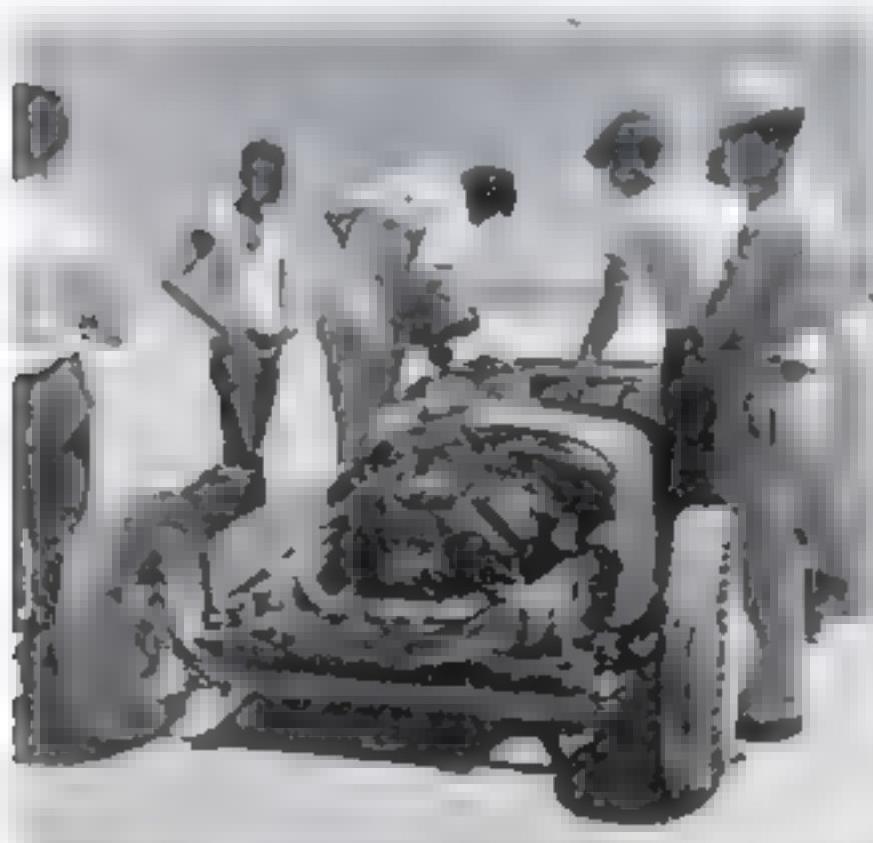
Clock starts when car breaks beam from spotlight (above) to photoelectric cell at start of 1-mile course. Breaking a second beam at finish line stops clock, which then shows elapsed time.



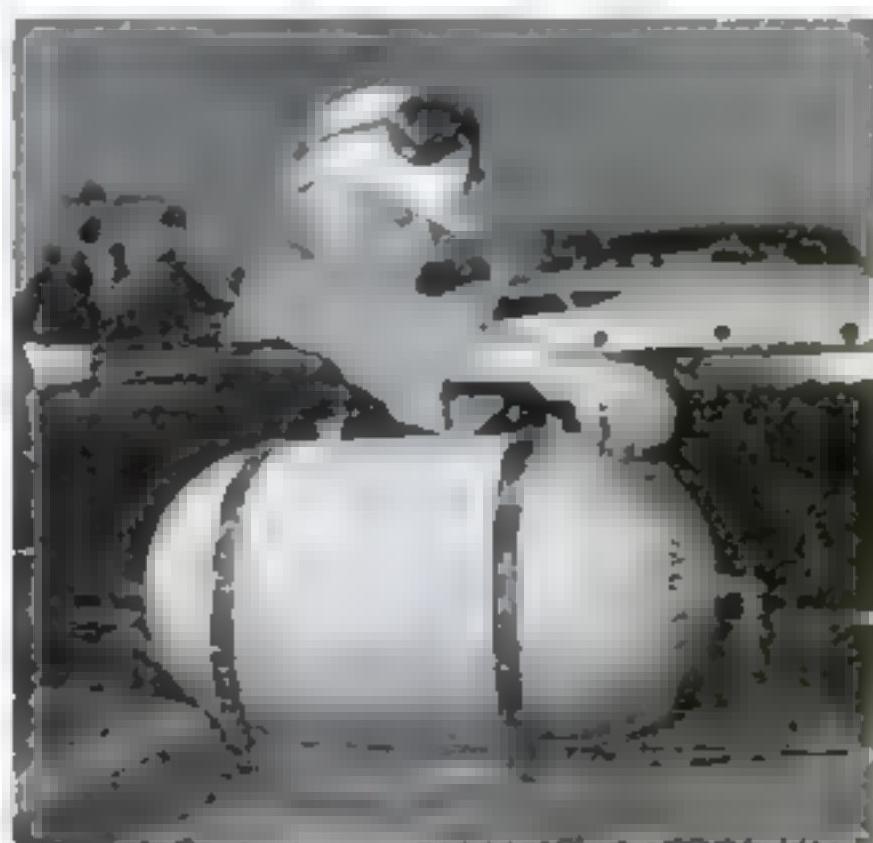
Hot rod is started by towing it with another car. Towline is attached to right front axle with airplane seat strap that can be unhooked while in motion by a tug on cord running to tow car.



Rear-engine speedster gets a push start. It has 1937 Cadillac V-8 motor mounted on the body of a 1923 Dodge roadster. Streamlined nose is a war-surplus wing tank cut in half.



Radiator is eliminated to sharpen nose of this model. Instead, it has a 10-gallon water tank behind engine. Car is drained after each run and takes an hour and a half to cool off.



Half the hot rods now burn alcohol instead of gasoline. This one carries its 5-gallon supply in an aircraft oxygen bottle. At better than 100 m.p.h., car gets about two miles to a gallon.

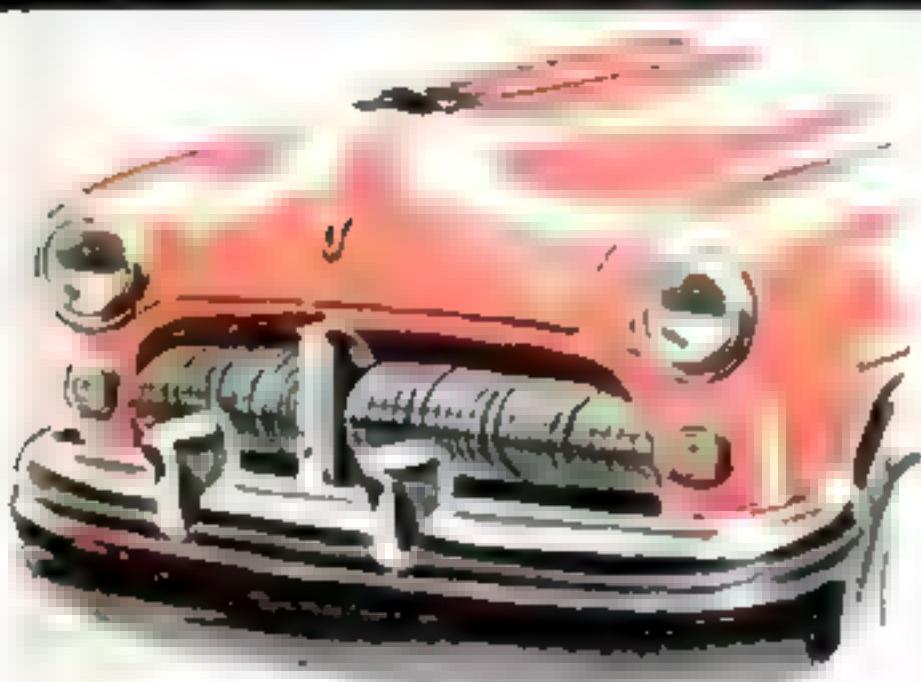
Do You Know Your '48 & '49 Cars?



1 _____



2 _____



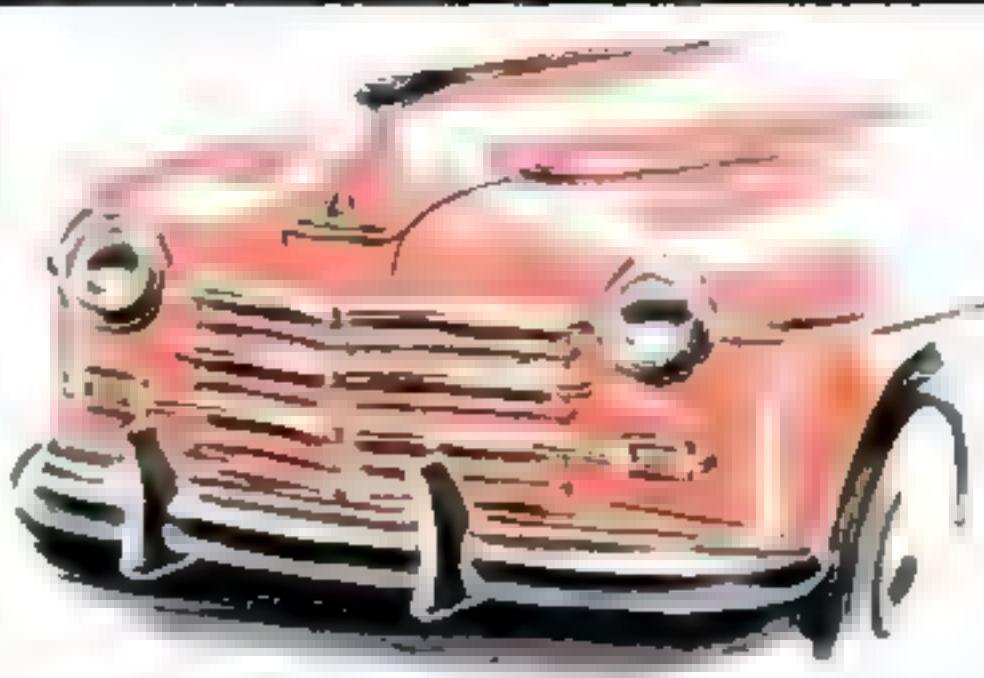
3 _____



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6 _____

WHAT new automobile has a T-shaped piece of chrome on its grille? If you've kept up with car styles, that's a feature you'll look for in identifying one 1948 model.

Here are front-end views of 12 new cars. By this time, you have seen them all. How many do you recognize? Answers are printed upside down in the adjoining column. If you name them all correctly, you're nothing short of a wizard.

models except the Lincoln and Mercury.
12, Studebaker Land Cruiser. All are 1948
missed this one, go to the foot of the class);
sons; 10, Plymouth; 11, Packard (if you
members); 7, Kaiser; 8, Cadillac; 9, Hud-
the 60 Series has four curving horizontal
mobile Series 88 Futuramic (the grille of
grille this year); 5, 1949 Mercury; 6, Olds-
4, Chevrolet (note T-shaped piece added to
1, Pontiac; 2, 1949 Lincoln; 3, Dodge;



3 _____



4 _____



1 _____



2 _____



11 _____



12 _____



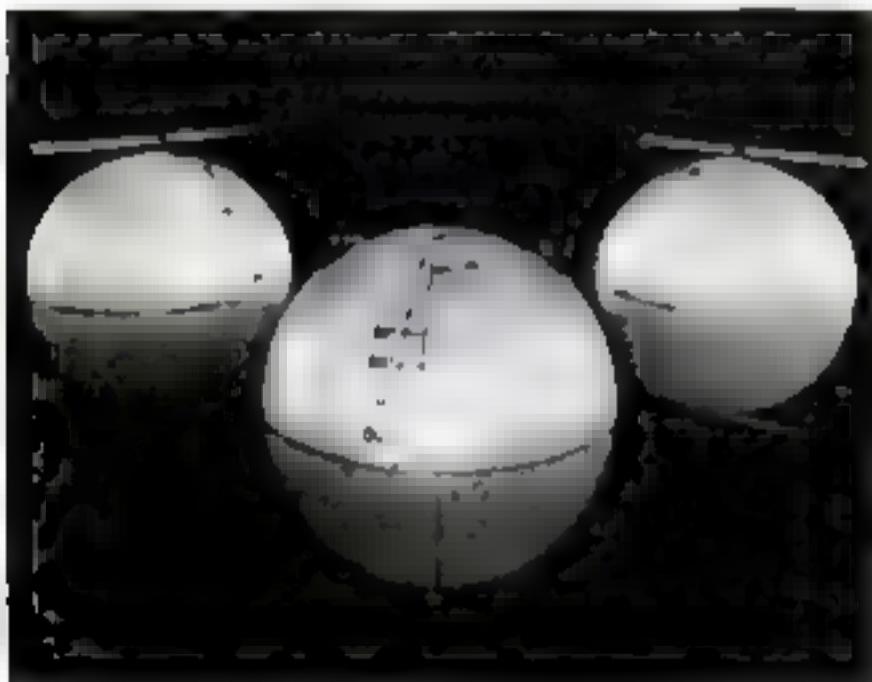
Pile Driver Runs Itself

THIS lightweight German pile driver, now in use at the U. S. Navy's Port Hueneme Proving Ground, Calif., is its own engine. Weighing only a ton, it is essentially a single-cylinder Diesel engine, with the 1,100-pound hammer acting as a piston. As the hammer falls to drive the pile, it compresses vaporized Diesel-oil fuel in a cylinder until spontaneous ignition occurs. The explosion drives the hammer back up again, and the cycle is repeated. For the first stroke the hammer is hauled up by a hand winch, after which the action is automatic. The hammer hits only about 50 strokes a minute but can drive piles that will support a 25-ton load.



To Warm or Cool You

HAVE a fevered brow you want cooled? Or a tummy ache you want warmed? Either one is possible with this combination ice pack and hot-water bottle. Called Hot-R-Cold Pak®, it is a folding, wallet-size, plastic pouch containing a special liquid that stays either hot or cold for a long time. For an ice pack, you simply chill it awhile in a refrigerator; for a hot-water bottle, heat it in hot water.



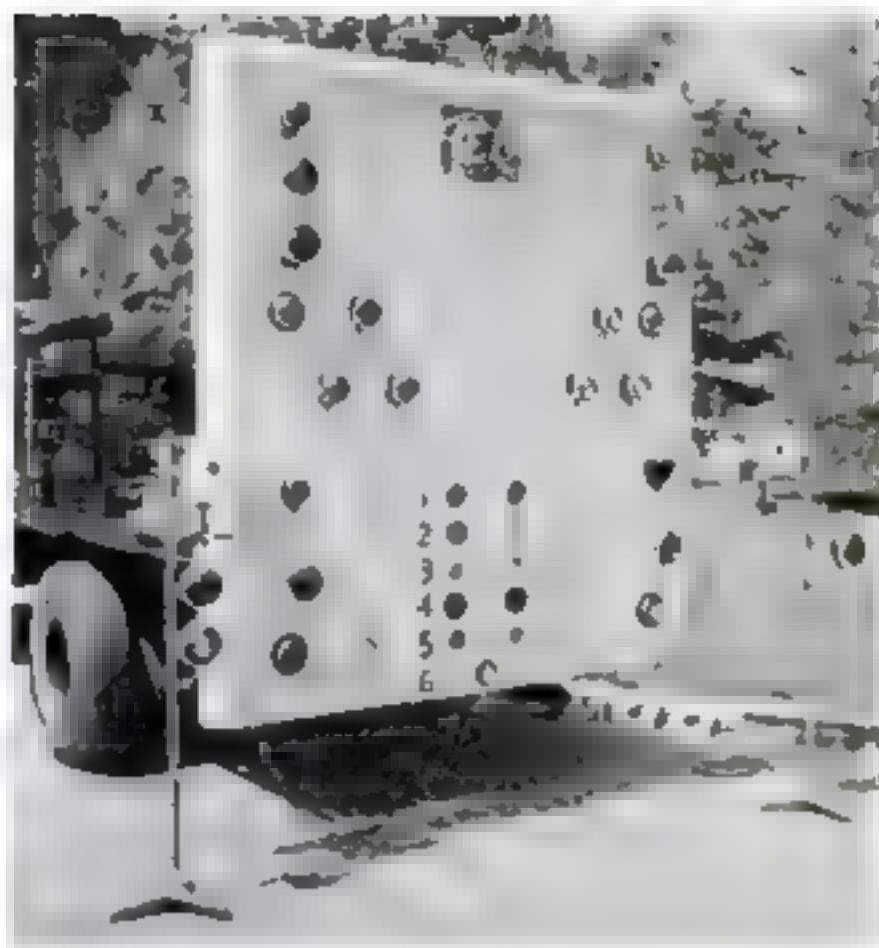
Globe Measures Light

SEEING triple? That's just what engineers at Sylvania Electric want to see when they study the light patterns of lens-type lamps whose beams are too broad for screen projection. They place an opal-glass globe over the lamp to be tested and then put mirrors behind it on both sides. This produces the arrangement shown at left and lets them see all sides of the globe at once. The globe, graduated in degrees, shows at just what angle the greatest amount of light is concentrated—in this case at about 72°.



"Hat" Maps Head Shapes

No, this isn't a new creation in ladies' hats—it's Bell Telephone Laboratories' latest gadget for getting the head sizes of its telephone operators. The graduated rods around the semicircular headpiece produce accurate contour maps of any head shapes. From these, Bell will design better-fitting, more comfortable earphone headbands.



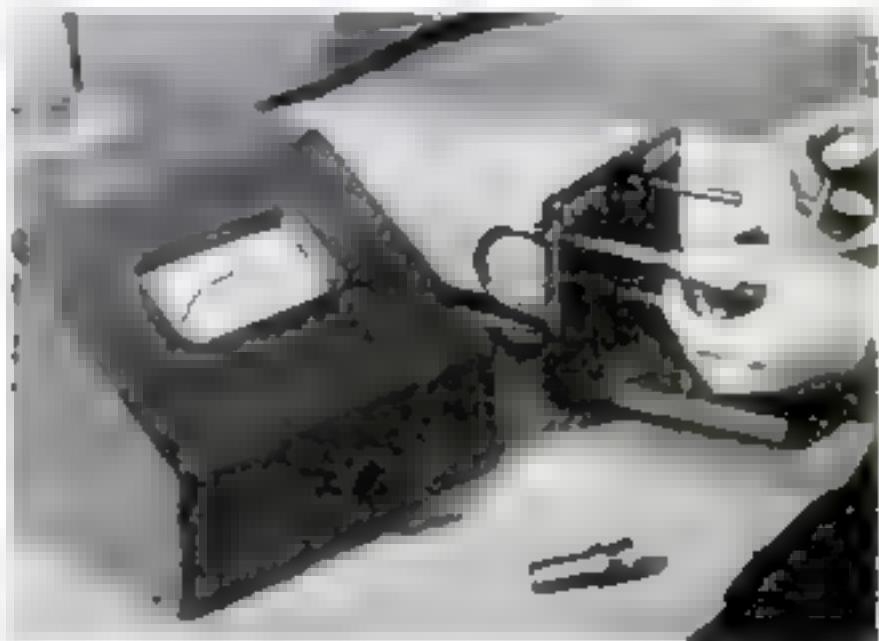
Panel Tests Truck Lights

You won't see a truck on the road with quite as many rear lights as this one has. Thanks to it, however, "stop" and "turn" signals on other trucks may be improved. General Electric designed the panel to test lights of various colors and brightness. The operator (at porthole) can turn them on singly or in any combination for viewing.



Billionth Amp Metered

CURRENTS as small as a billionth of an ampere can be measured with a new RCA micromammeter, shown above, designed for such ultra-sensitive jobs as gauging the light emitted by stars. The portable instrument covers the range from a billionth to a thousandth of an ampere. It can be converted to a high-resistance voltmeter or a high-range ohmmeter. Though sensitive, it withstands a 10,000 percent overload.



Millionth Inch Gauged

HOLDS too small to be measured with ordinary tools can now be gauged with this British device that shoots compressed air through them. The instrument actually measures how much an electric filament is cooled by an air stream escaping through the test hole. It compares this cooling effect to that of an air stream sent through a hole of known size. The makers claim the gauge feels differences of a millionth of an inch.

Sun's Daily Signals

**Short-range predictions based on a new discovery
enable the world's radio stations to counter magnetic storms.**

By Alden P. Armagnac

FROM an office-building rooftop amid New York's downtown skyscrapers, J. H. Nelson, radio engineer and official sunspot observer for RCA Communications, Inc., scans the solar disk daily through a six-inch

telescope. Making penciled dots on a circular chart, he carefully notes the position of blemishes upon the sun's face. Then he descends to an office where he dictates a brief message to his secretary. Within a few minutes, RCA's powerful transmitters are forewarning commercial stations all over the



In observatory atop a New York building, RCA's J. H. Nelson prepares for a look at the sun.

Direct Radio Traffic

world of what radio reception will be like within the next 24 hours, so that they can plan their schedules accordingly.

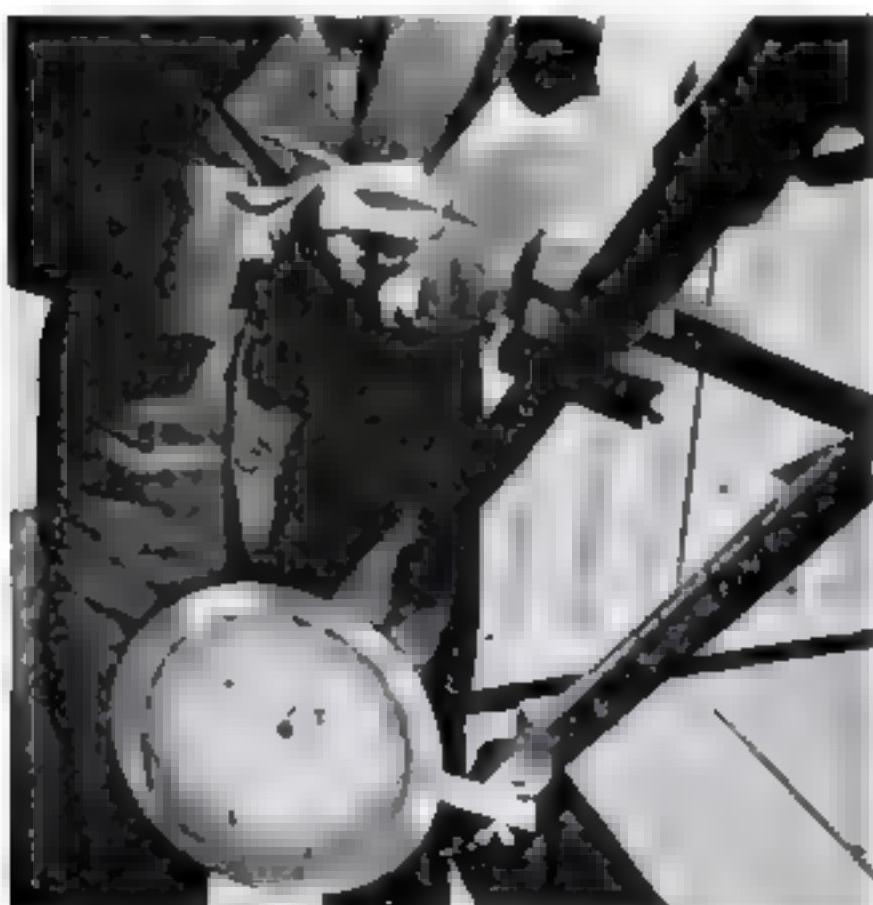
If the bulletin predicts an imminent magnetic storm that will turn shortwave messages into unintelligible gibberish-like a teletype machine gone haywire—San Francisco, London, Tangier, and other key stations have time to open up extra transmitting channels and get the messages through ahead of the storm. If it warns that a regular radio route will be particularly hard hit, engineers can warm up a “detour.”

Scientists long have known that sunspots brew the earth's magnetic storms and create disturbances in the radio-wave-reflecting layer of the earth's atmosphere, called the ionosphere, that aids long-distance transmission. Long-range forecasts based on 11-year sunspot cycles, issued for some time by the National Bureau of Standards, have already been providing valuable advance information on the frequencies likely to be least adversely affected three months hence. Now, RCA announces after months of successful trials, a way has been found to make accurate predictions of “radio weather” at short range—just a few hours in advance. This method has been developed by Nelson, in collaboration with H. E. Hallborg, re-

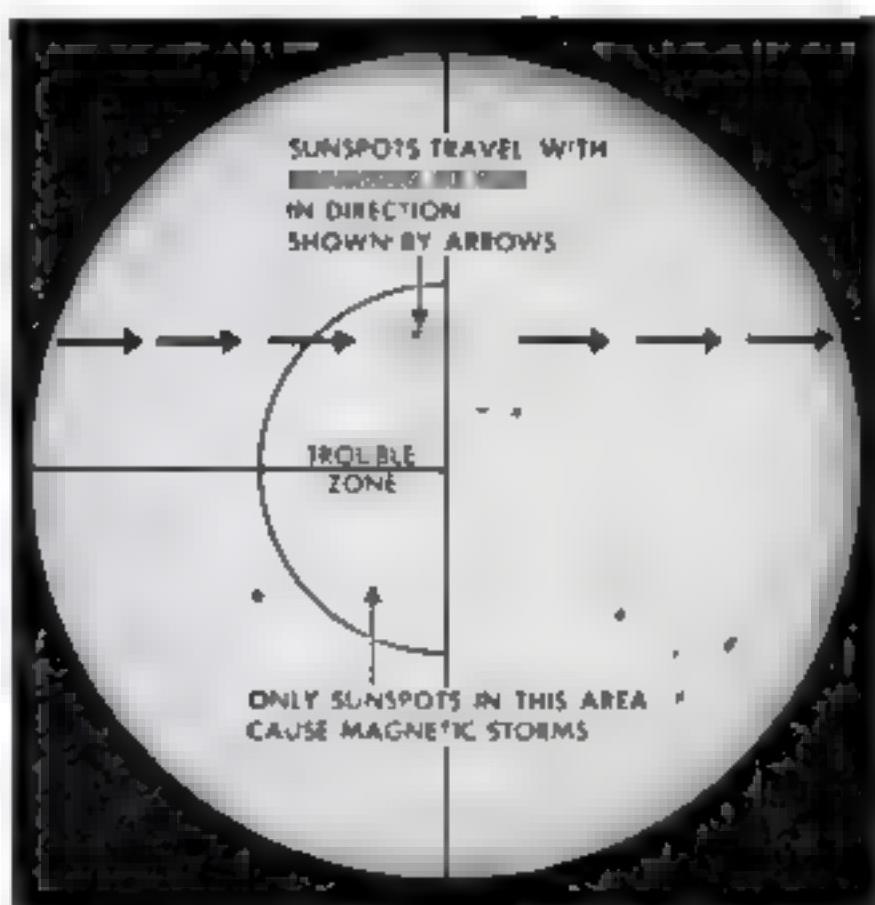
search engineer, and Miss Audrey Arzinger of RCA Laboratories, as an outgrowth of sunspot observations that Nelson made as an amateur astronomer in 1946 and 1947.

Sunspots, he has found, play hob with radio only when they drift across one particular part of the sun's face. This trouble spot, less than 1/10 as large as the sun's whole disk, has the shape of a half circle. Its straight side passes through the sun's center. The curved side faces the direction from which sunspots come. As they enter the semicircle, their mischief begins; as they leave, it ends. Since sunspots travel with the rotation of the sun, which revolves once in 27 days, movement of an individual sunspot can be predicted with great accuracy. Nelson has been able to forecast magnetic storms interrupting radio transmission to within 15 minutes of the time they actually occurred.

Aided by reports from Mt. Wilson Observatory in California—which classify the sunspots he is watching as “red” or “violet,” according to a shift observed in their spectral lines—Nelson can even tell where the disturbance on earth will be most severe. “Red” sunspots, which are electrically positive, affect radio in the upper latitudes of the Northern Hemisphere. “Violet” sun-



Projected image of sun's disk, on chart at end of telescope, shows sunspots as black specks. Here, Nelson uses duplicate chart to note their position, on which he bases the day's prediction.



New forecasting method results from Nelson's discovery that sunspots, seen above, affect radio only while they are passing through semicircular “trouble zone” near sun's center.



When magnetic storm hits North Atlantic, radio messages flow on without interruption via "detour" shown on map. Alerted by Nelson's advance warning, Tangier goes into action as

spots, electrically negative, strike hardest in corresponding latitudes of the Southern Hemisphere.

Knowing that a northern-latitude storm is about to cut direct, great-circle transatlantic links between Europe and America, RCA's New York headquarters can prepare to re-route its radio traffic around the trouble area by way of Tangier, in North Africa. A flash

relay for Europe-U. S. traffic. In foreground of photo, above left, a high-speed transmitter-receiver at RCA's New York headquarters is exchanging 480 words a minute with Tangier.

to the Tangier supervisor gives him ample warning to call in extra help, man additional transmitters and receivers, tune in European signals, and have them ready on automatic relays as New York calls for them. Thanks to a former amateur astronomer's glimpse through a telescope, the stream of news and urgent business messages flows on without a ripple.

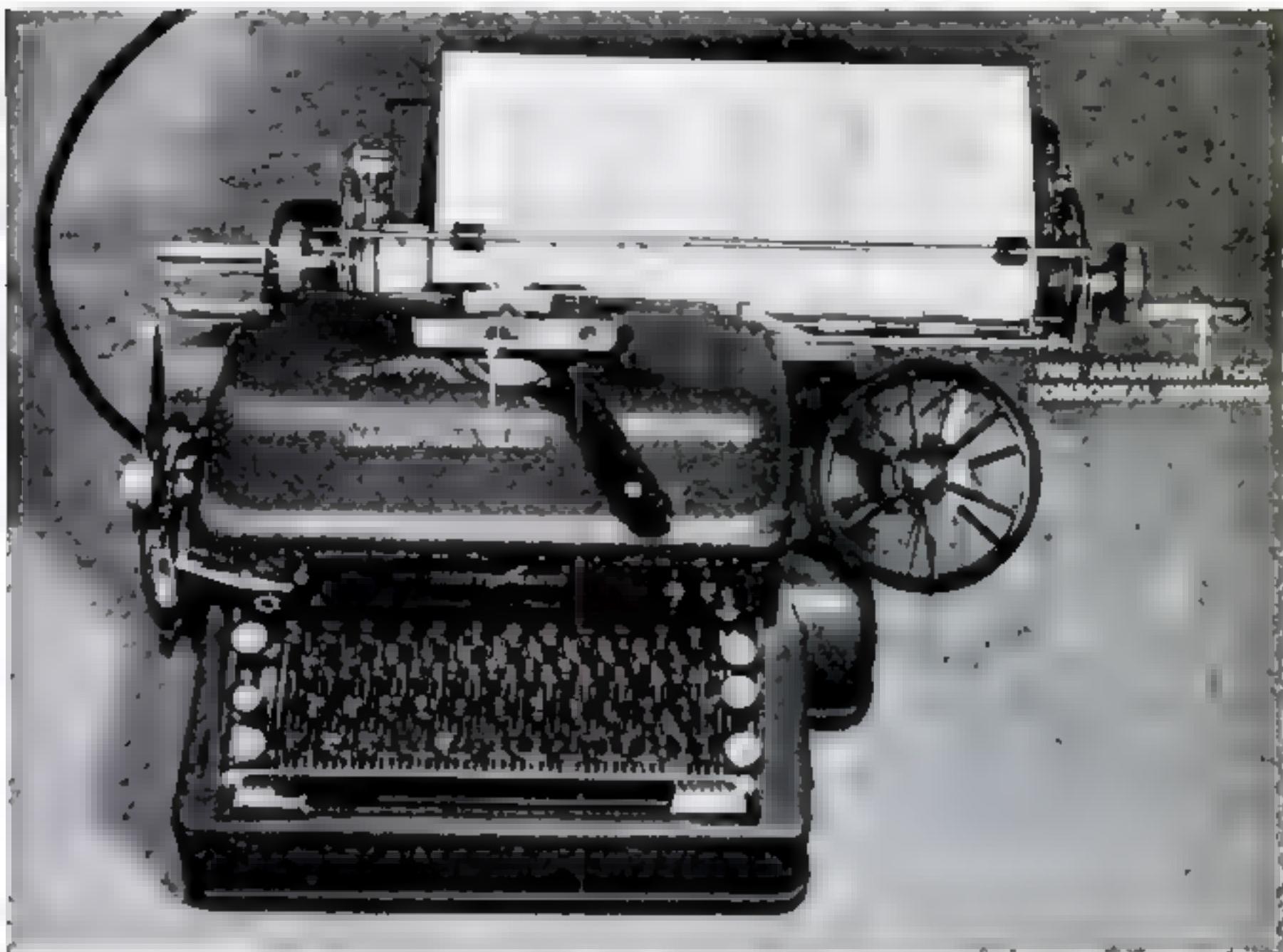
END

Navy Films Lake Bottom

USING the self-propelled barge and the photoflash-bulb rig shown below, Navy photographers are studying a submarine dust bowl—Lake Mead, backed up by Boulder Dam on the Colorado River. Photos taken

with underwater cameras show them how fast the silt dumped there by incoming water, an estimated 1,400 carloads daily, is robbing the reservoir of water-storage capacity. Their films and core samples to identify the source of the mud will guide them in planning preventive measures.





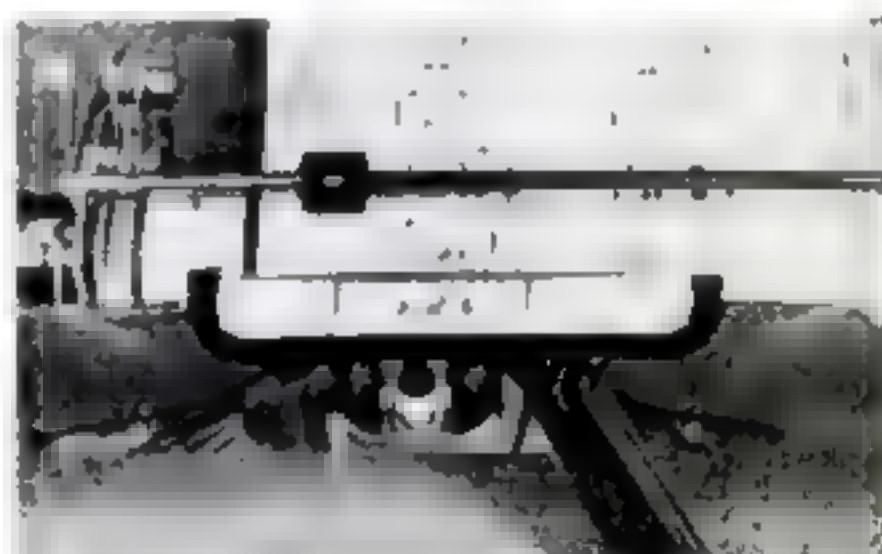
New music typewriter is standard IBM machine with special keyboard and type bars to make musical characters. Typist inserts ruled paper

edgewise and works down the columns from the upper right. Fine horizontal adjustment helps center notes on or between lines of the staff.

Machine Types Simplified Music

DOZENS of inventors have wrestled with the problem of devising a typewriter to write music. None so far has come up with a solution simple enough to displace the pen-and-ink hand method still used by commercial publishers. Failure by others, however, hasn't daunted Dr. Floyd Firestone, Washington acoustical engineer, who has invented the music typewriter pictured at the top of this page.

Dr. Firestone has attacked the problem through the back door: he first worked out a simpler way of writing music—then designed a machine to write it that way. His system of notation differs from standard style mainly in getting rid of the key signature. This is done by translating all sharps into flats, and identifying all flats individually by writing them as triangular-shaped notes. He says this makes music easier to read as well as simpler to write.



Prism magnifier, made by splitting an ordinary reading glass and bolting it to the typewriter, aids typist in adjusting the carriage for the careful spacing required in writing music.



Music written on typewriter has no key signature. Instead, triangular notes indicate black keys on a piano; round notes, the white keys.

New Gauge Speeds Wheel Alignment

ALIGNING a car's front wheels is a precision job. The best way to see whether they're exactly right is to measure how they behave when spinning at road speed with the car's weight on them. A device that does this in 20 seconds has been developed by the Ford Motor Co. and installed as the

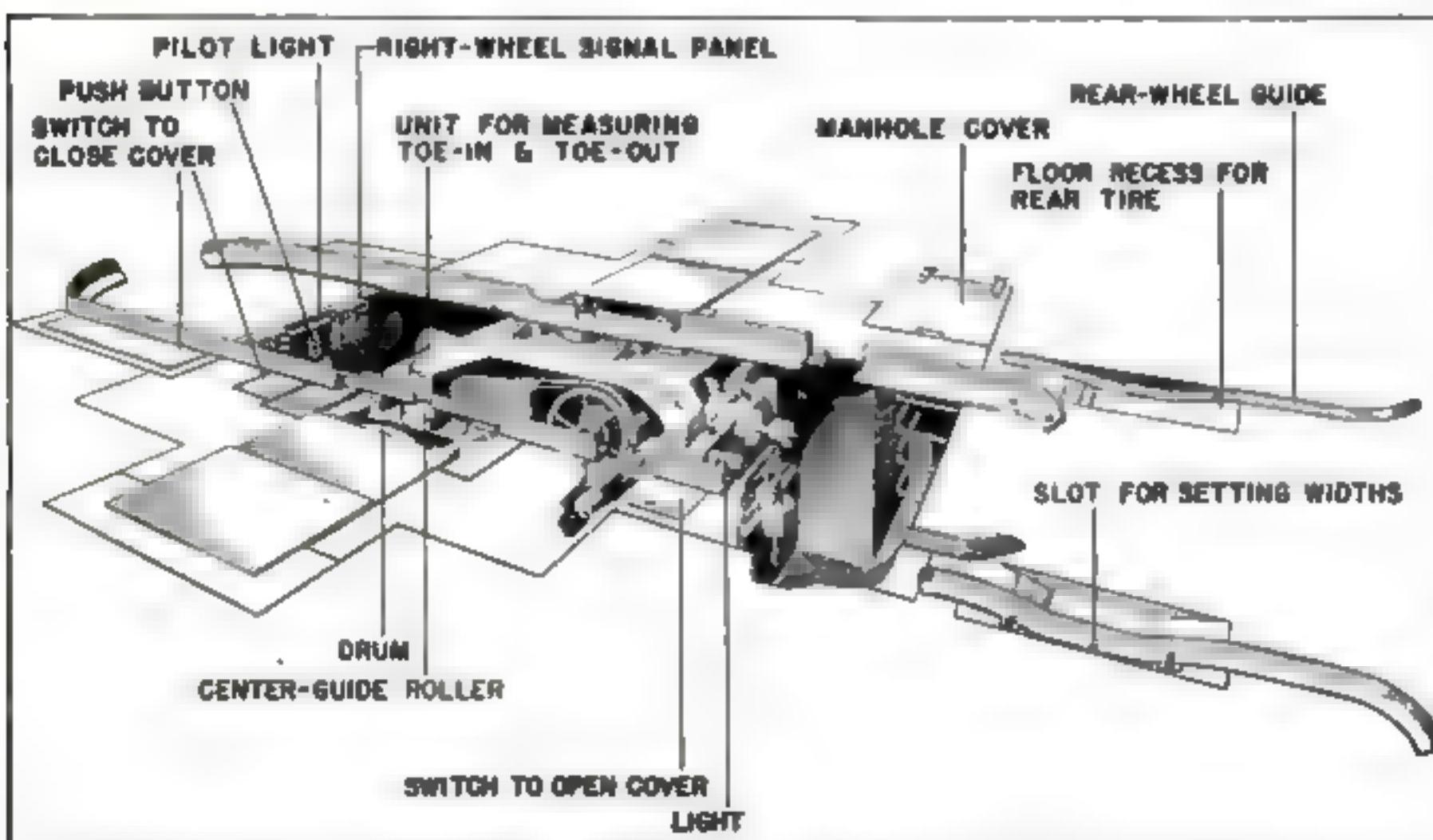
last stop on assembly lines now turning out its '49 models. On this roadability gauge a car's front wheels rest on two motor-driven spherical drums that spin them at 30 m.p.h. Their side thrust, if any, registers on a panel in colored lights—yellow for toe-in, green for toe-out—to guide adjustments.



New Mercury is driven onto roadability gauge. As front wheels approach pit, weight of car will slide covers back from powered drums on which the wheels will rest during the alignment test.



Operator makes adjustments to correct side-thrust of wheels indicated by flashing of colored lights on panel in front of him during test run. Gauge tests both front wheels at same time.



Cutaway view of new Ford wheel-alignment gauge shows arrangement of main parts in pit.

5407.



Windshield of Conducting Glass Melts Off Ice

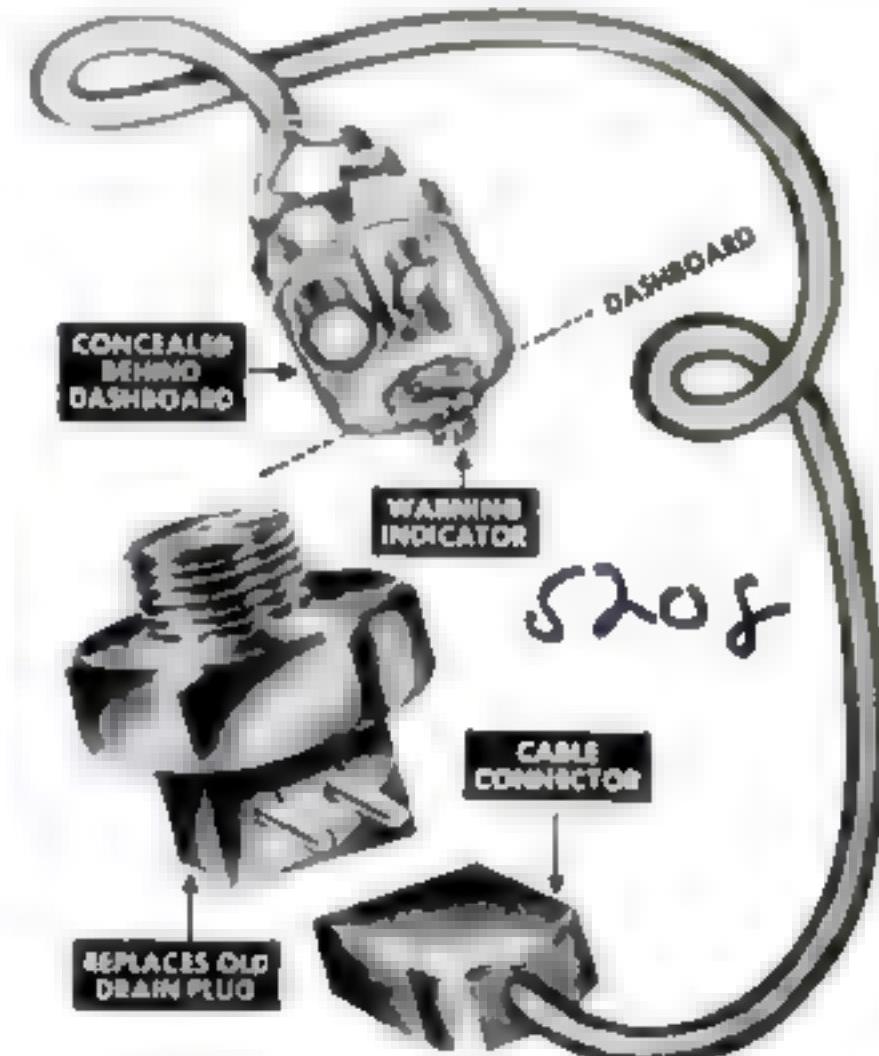
ICED windshields may seem no problem as yet, but with an eye to winter, Libbey-Owens-Ford Glass Co. is developing electrically heated ones. Perfected for war use, the safety-glass sandwich has an almost invisible film of stannic oxide on an inside

surface. This conducts electricity, generating heat said to keep the glass ice-free in subzero temperatures. As it requires higher voltages than passenger cars now have, it may appear first on trucks, buses, and police cars with AC radio generators.



Rear-Engine Car Has No Body

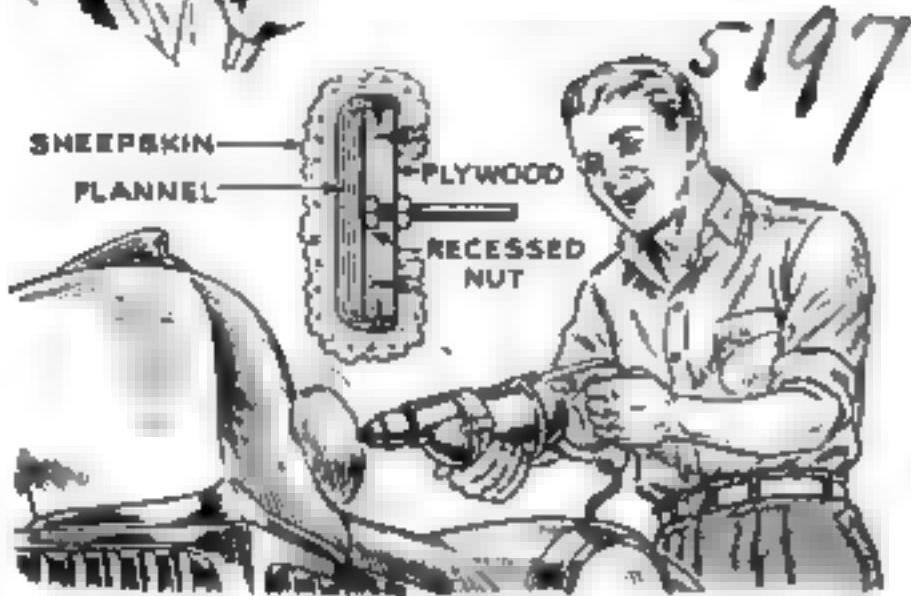
AN UNUSUAL feature of this 500-lb. racer is the front spring assembly, giving knee action through an overhead transverse spring from which the chassis is slung. The car, built by the Monaco Motor and Engineering Co., Watford, England, has a wheel base of only 5'. Rear wheels are 3' apart and front wheels 3' 10" apart. The rear-mounted Racing Norton engine develops 45 hp. It is not supercharged. A maximum speed of 100 m.p.h. is claimed for the midget, which was designed for short-distance racing. The Monaco has no body—it's just a chassis and power plant.



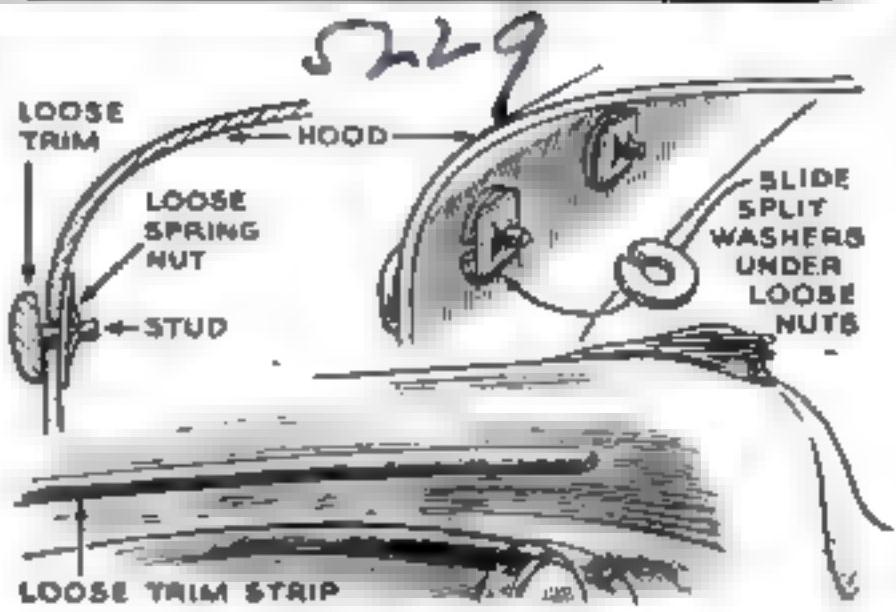
Light Warns of Low Oil Supply

AN AMBER dash light flashes on when engine oil drops 1 qt. below normal with this device. If the oil level drops 2 qt., a red light shines. Operating by the weight or head of oil in the crankcase on a resilient diaphragm, the Oil-Dicator $\textcircled{1}$ consists of a unit that replaces the oil drain plug and a dash fitting. Retailing at \$7.95, it's made by the Parkwood Mfg. Co., Haddon Heights, N. J.

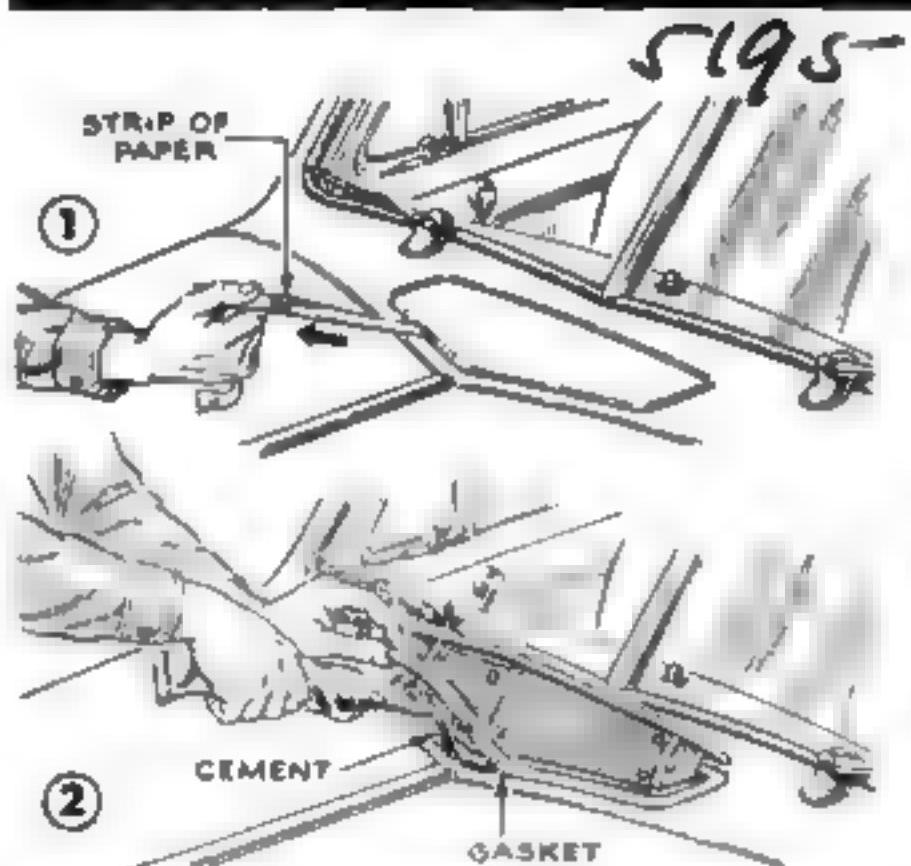
Hints From the Model Garage



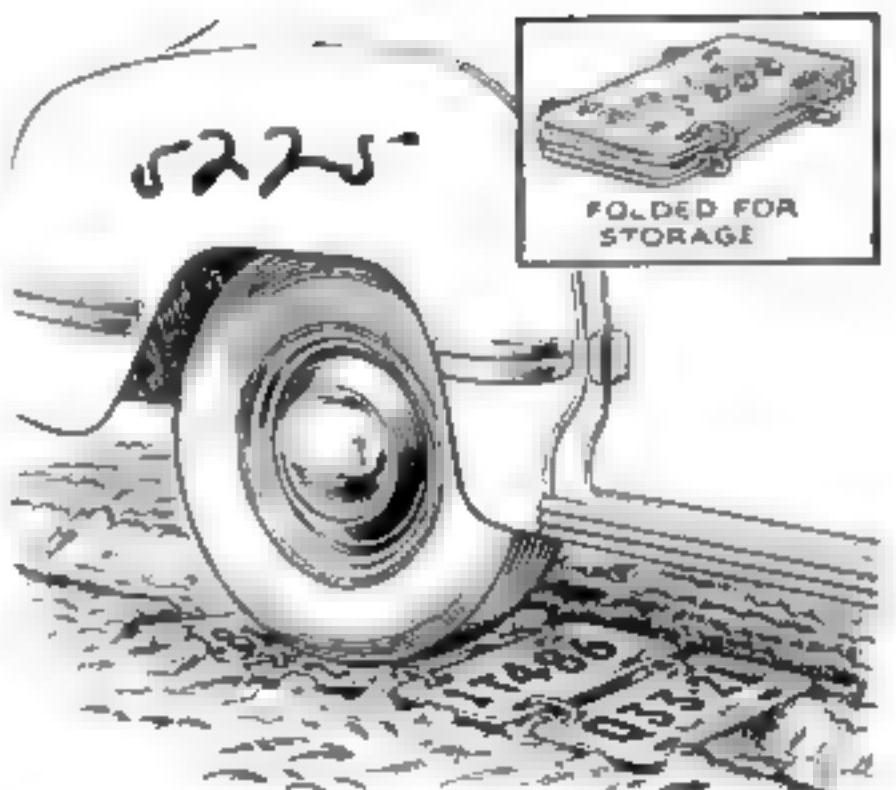
Make Your Own Polishing Pad. If you own an electric drill, it's a simple job to assemble a polishing attachment. Cut a 5" disk from $\frac{1}{8}$ " plywood, drill and counterbore it, and attach a shaft cut from a $\frac{1}{4}$ " bolt. Pad the face with several layers of flannel. Finish it off with sheepskin cut from a polishing mitt, tacking along the back.



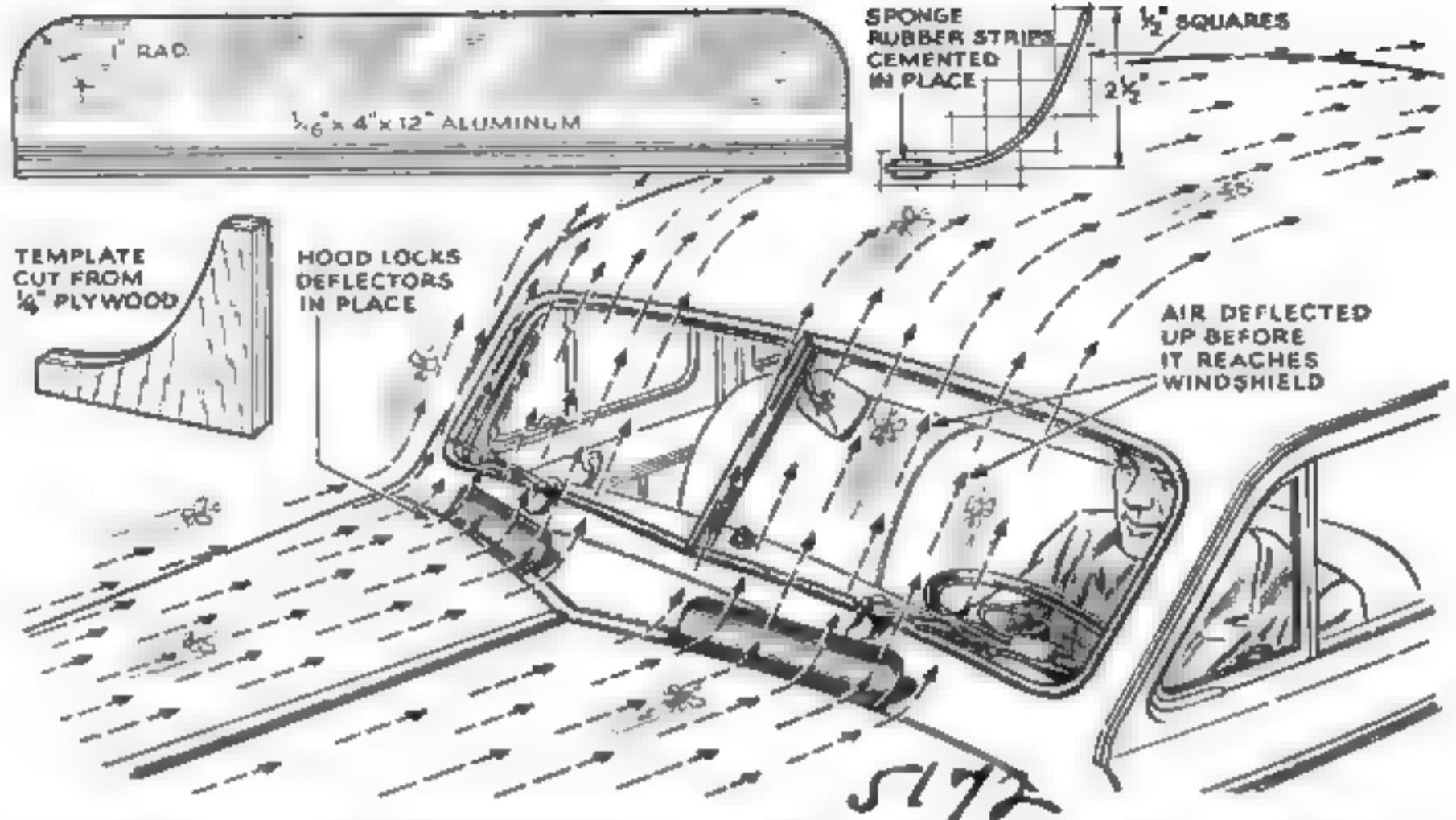
Washers Tighten Trim. Chromium trim often is attached with unthreaded studs and flat spring nuts. In time, wear on the studs may loosen the nuts and allow the trim to rattle and squeak. One way of tightening it is suggested above. Cut a section from a steel washer. Then force the washer behind the nut to take up the slack.



Repairing a Cowl Ventilator. Water may leak through a cowl ventilator unless the lid makes firm and even contact with the gasket. If a strip of paper can be withdrawn when the lid is closed on it (1), increase the lid tension by shortening the adjusting link you'll find under the instrument panel. It's also sometimes helpful to remove the gasket, clean it and its channel, and carefully cement in place (2).

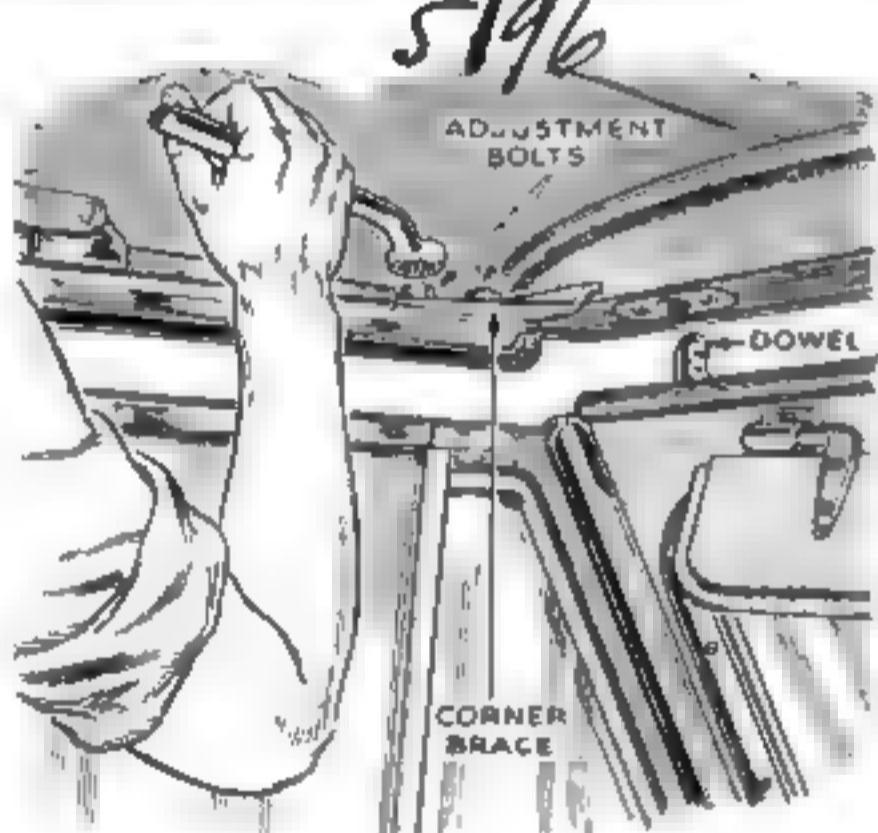


Plates Get You Out of Mud. What do you do with your old license plates? Throw them away? Tack them on the garage wall? Herman Marcus, of Jamaica, N. Y., has a better idea. Link at least four of them together, using wire or perhaps chain-repairing links, fold them into a compact bundle, and store in the luggage compartment. Then if you ever get stuck in the mud, you've got a ready-made mud track.

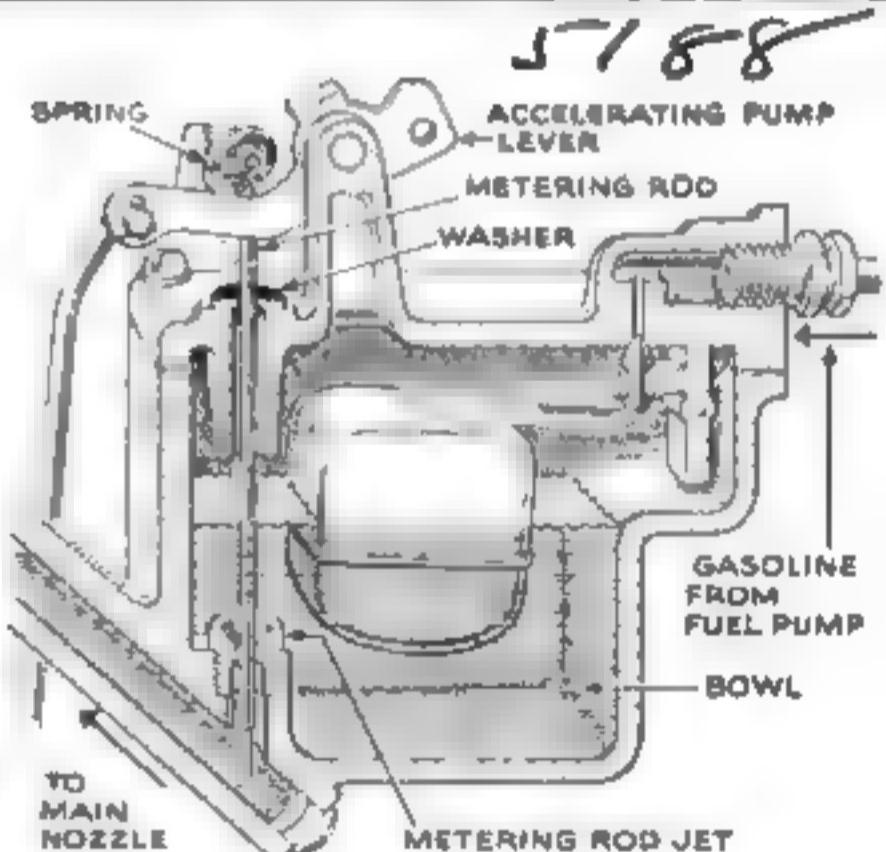


Bugs Kept Off Windshield. At this season, the spatter and smear of insects on a windshield makes seeing tough, especially at night. A. W. Schach, of Rockford, Ill., uses deflectors like these to overcome the problem. The sketch on $\frac{1}{8}$ " squares

shows the curvature that will deflect air over the roofs of most modern cars. Cut a plywood template to this curvature as a guide when bending the aluminum. Either polish the aluminum to a high luster or paint it to match the car.



Adjusting a Folding Top. Convertible tops on General Motors cars may be adjusted either forward or back if the dowels don't hit their holes in the roof rail. First, unlatch the top and raise it slightly. Next, loosen the adjustment bolts. Then move the corner brace until the dowels and holes are properly aligned. In some cars, a different corner brace is used, but the adjustment is essentially the same.



Carburetor Service Tip. In a modern carburetor of the metering-rod type, the little spring at the top of the metering rod and the sealing washer are points that occasionally give trouble. If the spring is missing, the rod may vibrate sufficiently to unseat the washer. This admits full atmospheric pressure to the chamber. Rough engine performance or high fuel consumption may sometimes be traced to this.

Gus Gets Broken

4447



in by a New Helper

When Stan Hicks graduates to a full-fledged mechanic and a new grease monkey comes to the Model Garage, time hangs heavy on extra hands.

By Martin Bunn



The inner side of the radiator was badly gashed. It looked as if the harm had been done by the fan blades.

"HEY, mister—what should I do now?" Gus Wilson, flat on his back under the jacked-up rear end of George Knowles's car, looked up at Greg Jones, the Model Garage's new grease monkey. "Well," he suggested, "you might sweep out the shop."

"I've done that," Greg told him.

Gus slid out from under the car and looked around. The floor had been swept thoroughly and the waste boxes had been emptied. As far as he could see, all the routine Monday-morning jobs had been well done. He glanced at the clock. It wasn't nine yet. How was he going to keep this green kid decently busy? Gus promptly made up his mind to sidestep the job.

Stan Hicks, relieved at last of the "boy's work" that had gripped him so, was importantly busy over a valve-grinding job. Gus nodded toward him. "Any time you don't know what to do next," he said, "ask him."

"I did ask Mr. Hicks, and he . . ."

"Go ahead," prompted Gus. "What did Mister Hicks say?"

"He told me to ask you."

"Buck passer!" From outside came the squawking of a horn. "Well, go out to the pump and see who's making that noise."

Greg hurried out. Joe Clark, coming in from the office to collect Saturday's time and parts slips, grinned at his partner. "How's the new boy doing?" he inquired.

"He's left-handed," Gus growled, "and he's got ten thumbs."

Joe laughed. "Give him a chance. The school people say he's a bright kid and a hard worker, and he did well in his mechanical-aptitude test."

Greg hurried back into the shop. "Hey, mister," he reported breathlessly, "there's a lady out there wants to buy five gallons of gas. What'll I do?"

"Sell it to her."

"Yeah—but I don't know how to work the—the—the thing!"

Gus groaned. Joe laughed again. "Come along. I'll show you how."



Three minutes later Greg dashed back. "Hey, mister—the lady's car won't run! Mr. Clark wants you to come out."

Muttering under his breath, Gus followed him out to the pump, where the downstairs two-thirds of Joe's anatomy was protruding from a shiny coupe. A tall, thin woman stamped her foot angrily. "I'll register a complaint! A brand-new car to act like this! First my husband takes it on a business trip the day we get it. Then, the first time I get to drive it, this has to happen!"

"What seems to be the matter, ma'am?"

"I had five gallons of gasoline put in," she snapped, "and now it won't start!"

Joe ducked his head out. "Deader'n a doornail," he told Gus gloomily.

"Let me try it." Gus stepped into the car and pressed the starter button. The engine caught and purred sweetly.

"Well, I never!" shrilled the angry lady. Gus switched off the engine and got out. She hopped into the driver's seat. A minute of silence was terminated by her outraged voice: "It's just the same! It won't start!"

Joe smiled reassuringly. "Well, now, Mr. Wilson started it without the slightest difficulty, so—just let me try it."

She slid over, and Joe took her place. There was another short silence. Then Joe stuck his head out of the window. "She's dead, Gus," he reported.

Gus got in and again pressed the starter button. Again the engine took off promptly.

"Well, I never!" The customer thrust her jaw out. "If you can do it, there's no reason why I can't. Let me try again."

Gus got out, and she slid back behind

the wheel. There was another silence. "It won't start!" she grated bitterly.

Everyone had forgotten about Greg. Now he twitched at the sleeve of Gus's coveralls and pulled him a little aside. "Hey, mister," he said in a hoarse whisper, "I know why you can make the motor run and they can't."

"You do, hey?" Gus said. "Why?"

"You push the thing up on top, and they stamp on the thing down on the bottom."

Gus stared at him. Then a grin spread over his face. "By gum," he said, "you've got more sense than any of the rest of us—which isn't saying much." He went over to the car and asked the woman to try to start its engine. This time he held the door open. She pawed with her left foot at the floor to the side of the clutch pedal, and then looked at him aggrievedly. "It's just the same," she said. "It's dead!"

Gus reached in to the instrument panel and pressed the starter button. At once the engine ran sweetly. "The trouble," he told her, "is that you've been trying to start your engine by stepping on your headlight-dimmer switch!"

The driver's long jaw sagged. But after a dejected moment the light of battle flared up in her eyes. "It's ridiculous!" she shrilled, "that all cars aren't arranged the same way. On my old car the starter was on the floor. Why did they have to stick it up there on the dashboard? There should be uniformity!"

She let in her clutch, and the coupe was off to a jack-rabbit start. Gus turned in time to see Joe disappearing through the office doorway. Even at that distance Gus saw that his partner's ears were a fiery red.

Greg again pulled at his sleeve. "Hey, mister," he asked, "what'll I do now?"

Gus fished a dollar bill out of his pocket. "You know that cigar store near the station?" he asked. "Well, get me a half-pound can of 'Delight' tobacco."

Greg hurried off, and Gus went back to his shop. "It'll take him half an hour to walk down there and back," he thought, "and I'll have a little peace for that long."

GUS was wrong about that. He hadn't got well restarted on his job when he heard the harsh scream of jammed-on brakes.

Stan Hicks hurried over to the shop door. "A guy in a sedan nearly ran up a truck's tail," he reported. "I don't think he hit it, but there's something the matter—he and the truck driver are having a row."

Gus grunted disinterestedly. Stan continued to observe the ruckus out on the street. "Say, boss," he said after a few minutes, "that guy's back in his car, and he's drivin' it in here."

"He's all yours, Mister Hicks," Gus told him. He got a worm's-eye view of a red-faced man with a bristling black mustache hopping out of a sedan with a steaming radiator.

"Huh," Stan remarked, "so you did hit that truck. I thought you just missed it."

"I did not hit it!" roared the sedan's owner. "And no thanks to its driver. I'll have the law on his firm if they don't pay for the damage, sure as my name's Gunzenhouser! Stopping smack in front of me, and no stoplight or signal!"

"That's bad," Stan said sympathetically. "But if you didn't bump the truck, what busted the radiator?"

Gus didn't hear much of Mr. Gunzenhouser's heated and lengthy reply—he was distracted by a rustling sound near his feet, and on looking down saw Greg crawling toward him with a package in his hand. "Here's your tobacco, mister," he panted.

"Thanks," Gus said disgustedly. "How'd you get back so quick—take a plane?"

"I thumbed a ride both ways," Greg explained. "What'll I do now, mister?"

"Go tell Mr. Clark I said for you to help him in the stockroom."

Greg crawled away, but after a few minutes Stan came over to Gus. "You'll have to help me on this one, boss," he admitted. "I can fix the guy's radiator, but I can't find out what busted it. There's not a mark on it outside."

"Oh, all right," Gus said, and went over to the sedan. He examined the inner side of its radiator, and found it badly gashed. It looked to him as if the damage had been done by the fan, but careful checking showed that there was adequate clearance between the fan blades and the radiator, that the blades were tight, and that there was no end play in the fan shaft.

Gus scratched his ear and whistled tunelessly between his teeth. After half a minute he turned to Gunzenhouser. "You say you didn't hit that truck?" he asked.

"Didn't touch it. Take my word for it."

"I do. Well, now—ever had any trouble with your radiator hoses leaking?"

"I certainly have!" Gunzenhouser snapped. "They've been a nuisance for the last couple of months. I tightened 'em a couple of times and that didn't do it. I even took 'em off and put on gasket cement."

Gus nodded. "Does your throttle stick or fly open on turns?"

"What are you—a mind reader? Yes—my throttle often sticks when I make a turn at fair speed."

"One thing more," Gus said. "Have any starting trouble?"

"I've had a little," Gunzenhouser replied. "Now suppose you answer a question. What's the matter with my car?"

"Broken or worn-out engine supports," Gus told him. "When certain types of rubber engine mounts get old they soften up or separate from their metal brackets and allow the engine to settle or get out of line. The radiator hose tries to hold it upright, but of course it can't, and the strain opens leaks. On turns, the drag of the engine on the throttle linkage makes the throttle either stick or fly wide open. Hard starting is caused by the bad mounts allowing the rear of the engine to set so low that the kick throttle can't release the automatic choke when the starter is operated. Your mounts are so far gone that when you made a sudden stop, the engine shifted forward and drove the fan blades into the radiator. . . . New engine mounts—that's the only answer."

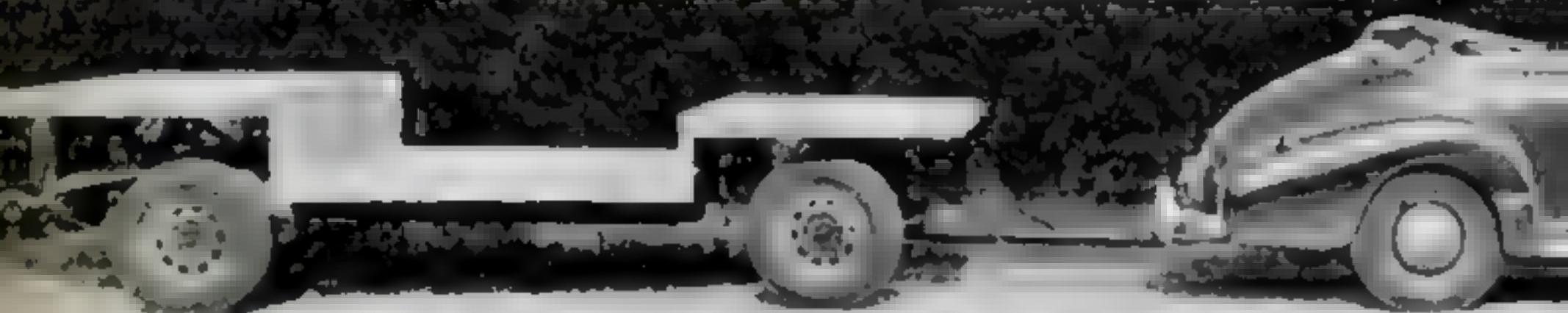
"You're the doctor," Gunzenhouser said. "Put 'em in, and fix the radiator. I'll be in for the car tomorrow. Okay?"

"Okay," Gus agreed. He returned to the Knowles job. "Now," he growled, "I hope I'll have a chance to do some of *my* work!" Then he felt a hand on his arm.

"Mr. Clark's through with me," Greg said. "What'll I do now, mister?"

END

Adding Vacuum Brakes to a Trailer



Hydraulic brakes on this trailer are operated from tow car. A hand valve (inset) releases a

vacuum cylinder linked to the hydraulic master cylinder. A gauge shows the vacuum being used.

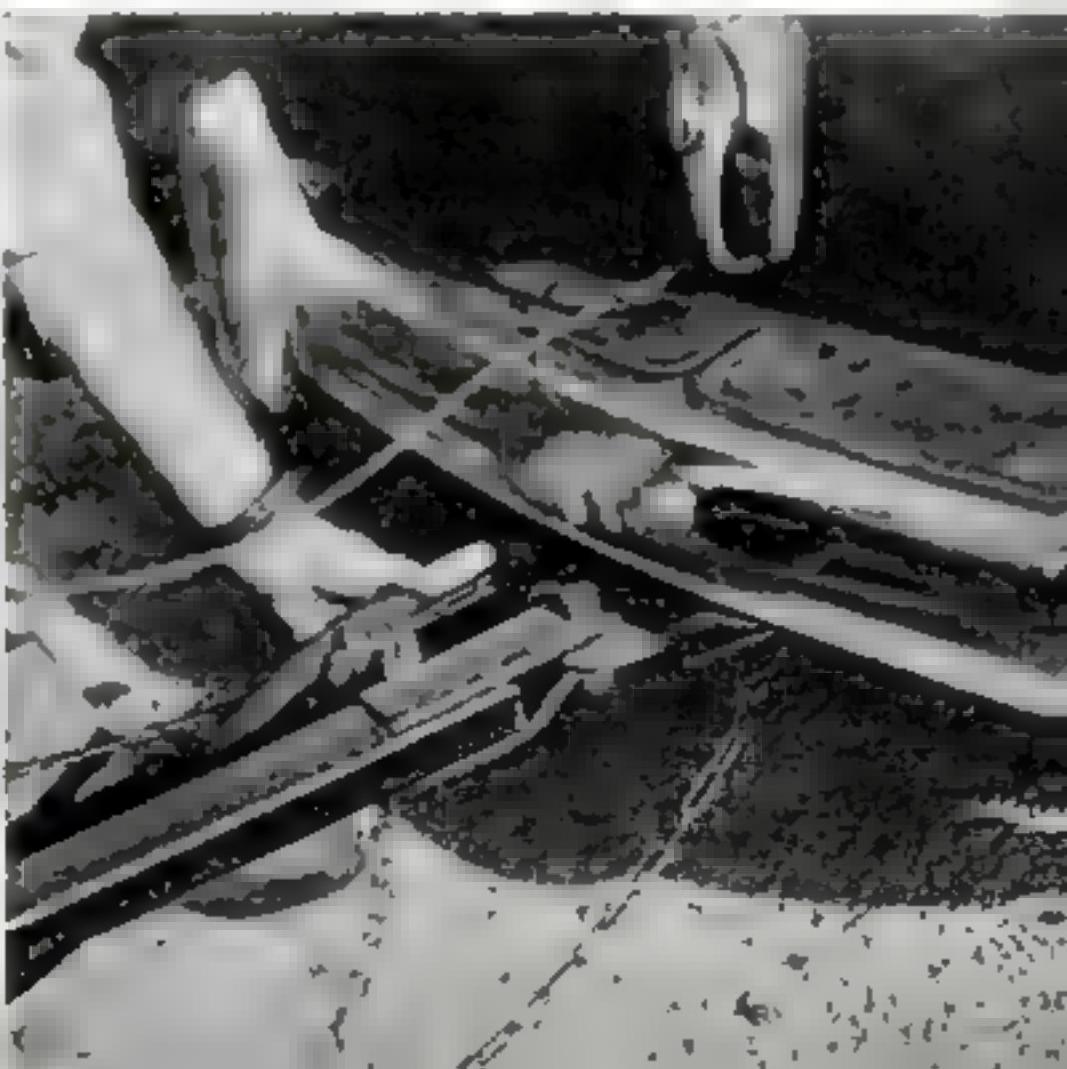
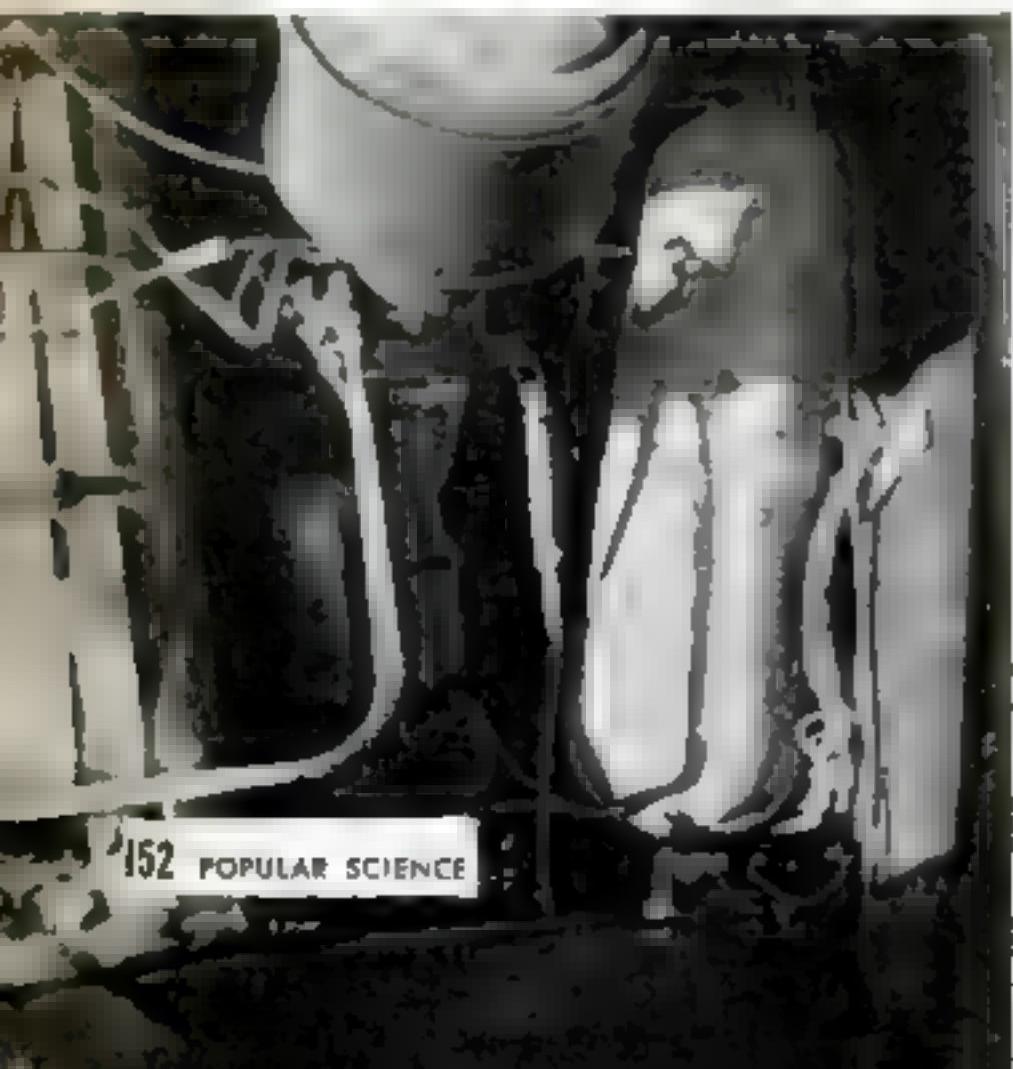
STIPPED down to serve as a trailer, the old auto chassis above still has its hydraulic brakes but they're now applied by vacuum instead of by foot pressure. The intake manifold of the towing car provides

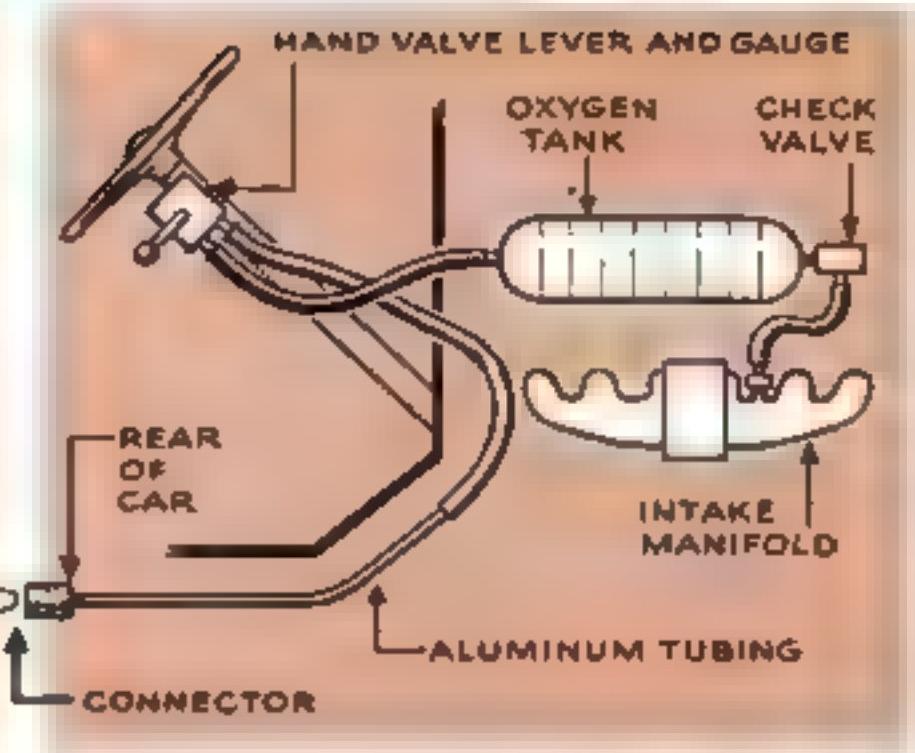
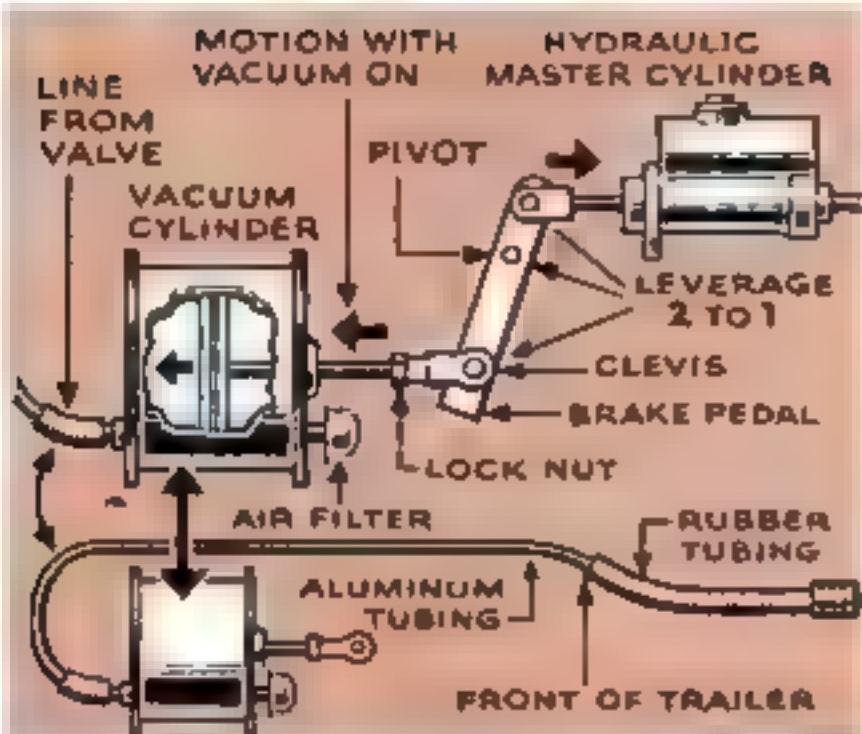
the vacuum. A vacuum line connector designed for trailer trucks allows quick coupling or uncoupling of the trailer.

Nearly all the parts required were obtained from a truck-supply company. No

Reserve vacuum for faster brake action comes from this booster tank. There's a check valve in the vacuum line from the intake manifold.

A connector designed for trucks couples the vacuum lines and a plug makes the electrical connection. Most states require safety chain





changes were made in the chassis aside from installation of a towing and steering mechanism and addition of two extra leaves to each spring. A drop center in the trailer floor lowers the center of gravity. If desired, a house trailer could be placed on this chassis, or the brake system adapted to a two-wheel house trailer.

The trailer brakes are operated with a hand valve clamped to the steering column of the car. This valve includes a gauge to indicate the vacuum being applied. A booster tank with a check valve provides reserve vacuum. This was originally an oxygen tank, obtained from a war-surplus outlet. A T-fitting, substituted for the wiper fitting on the manifold, permits attachment of both the wiper and brake lines.

Two $\frac{1}{4}$ " holes were drilled in the instrument panel, one for the line from the manifold to the hand valve and another for the line to the trailer. Most of the line is $\frac{1}{4}$ " aluminum tubing, but thick-walled rubber tubing was used at some points for flexibility.

The vacuum cylinder used in this installation has identical outlets at each end to give either a pulling or pushing action. About 8" in diameter, the cylinder has a $5\frac{1}{2}$ " stroke. Only a small part of the stroke is employed, however, when the brakes are properly adjusted.

In this case, it was found possible to retain the brake pedal as the linkage between the hydraulic and vacuum cylinders. Swung downward to provide clearance for the trailer floor, the pedal was pivoted for a two-to-one leverage. Its lower end was drilled for connection to the vacuum-cylinder piston. With the position of the pedal reversed, the cylinder pulls to apply the brakes.

Except on trailers of welded construction, a two-wire electrical circuit to the tail, clearance, and stop lights probably will do the best job. The hot side can be taken off the car taillight and the other side grounded. On the trailer, hook up the stop light through the master-cylinder switch so it will operate when the brakes are applied.

A little practice will show how much vacuum is needed to apply the brakes evenly. Smoothest action is obtained by pulling the hand valve a short distance, releasing it, and then pulling again. Full vacuum will usually slide the wheels. When parking with the engine shut off, it's probably wise not to count on the trailer brakes, though this one has held full vacuum for as long as 45 min.—Charles T. Pearson, Chicago.

Simple Light Checks Timing

HERE'S a simple timing light that will help you check and adjust the setting of distributor points. It also serves as a handy trouble light.

It was made by soldering the socket of a single-contact parking-light bulb to the pivoting end of a storage battery clip. One end of a 6' length of insulated wire was then attached to the socket and the other to a small battery clip. It may be used for timing by attaching the small clip to the low-voltage distributor terminal and clipping the bulb in a place where it will illuminate the flywheel timing mark as it flashes on. This will enable you to rotate the distributor body as required.—John M. Avery, Delhi, N. Y.



Jeep Gets the Full Treatment



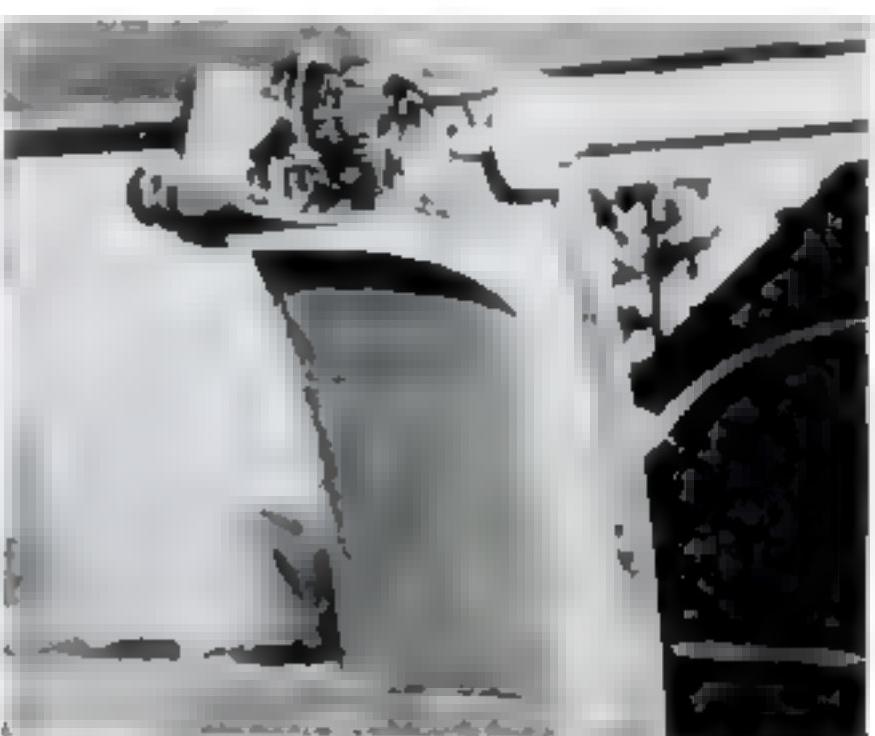
A special body was fabricated from sheet steel. The doors are power operated, and the curved windows are clear plastic.

SOME surprising changes can take place when imaginative mechanics get hold of a Jeep. This one is the off-duty work of two members of the U. S. Air Force stationed in Japan. Buying a Jeep for \$335, they discarded the old body and planed down the cylinder head to boost compression. Then

they drew up specifications for a striking new body and engaged a Japanese bus factory to build it. Among the many features are power-operated doors and leather-upholstered seats that fold to make a bed. When complete, the job had cost less than \$1,000, including about \$400 for the body.

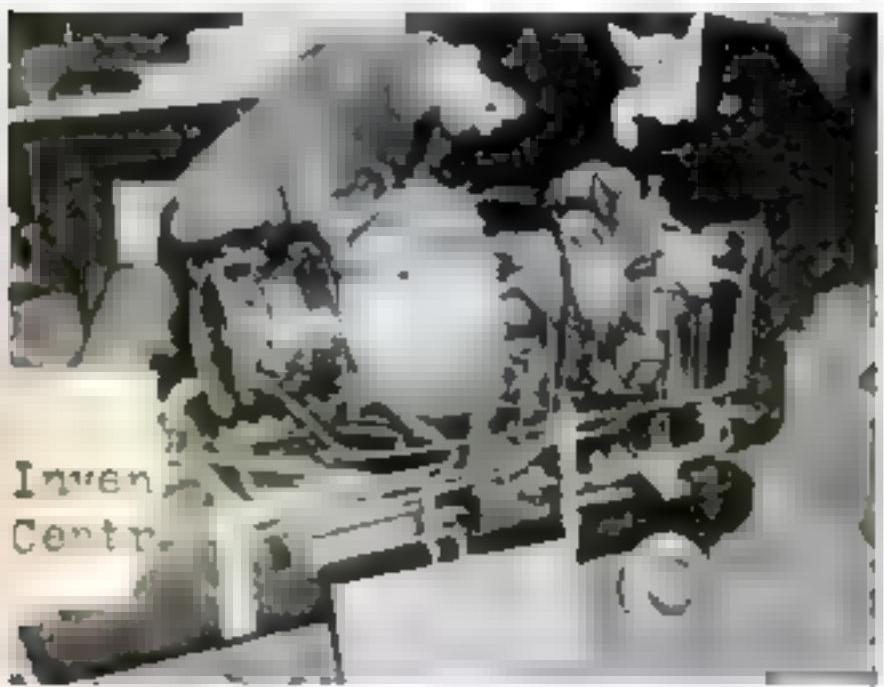


The driver's armrest swings down out of the way to allow unobstructed entrance and exit.



This mechanism operates the doors. The housing has been removed here to show it more clearly.

British Test Gas Turbine as Auto Power Plant



154 POPULAR SCIENCE

DESIGNED especially for use in passenger vehicles, this gas turbine is now undergoing tests in England.

Adapted from aircraft gas turbines, it weighs only 300 lb., develops 160 hp., and burns almost any oil as fuel. The British designers have given no hint, however, whether it overcomes two problems encountered by other experimenters—objectionable exhaust blast and excessive fuel consumption (PS, Nov. '47, p. 128). It has an electric starter and a glow plug for starting ignition. Power is delivered to a hydraulic coupling that operates at 17,000 to 35,000 r.p.m.

5326



Abrasive Wheel Slices Steel

PAGE 188

Spray On a Velvet Coating

PAGE 160

What's New in Jet Models?

PAGE 164

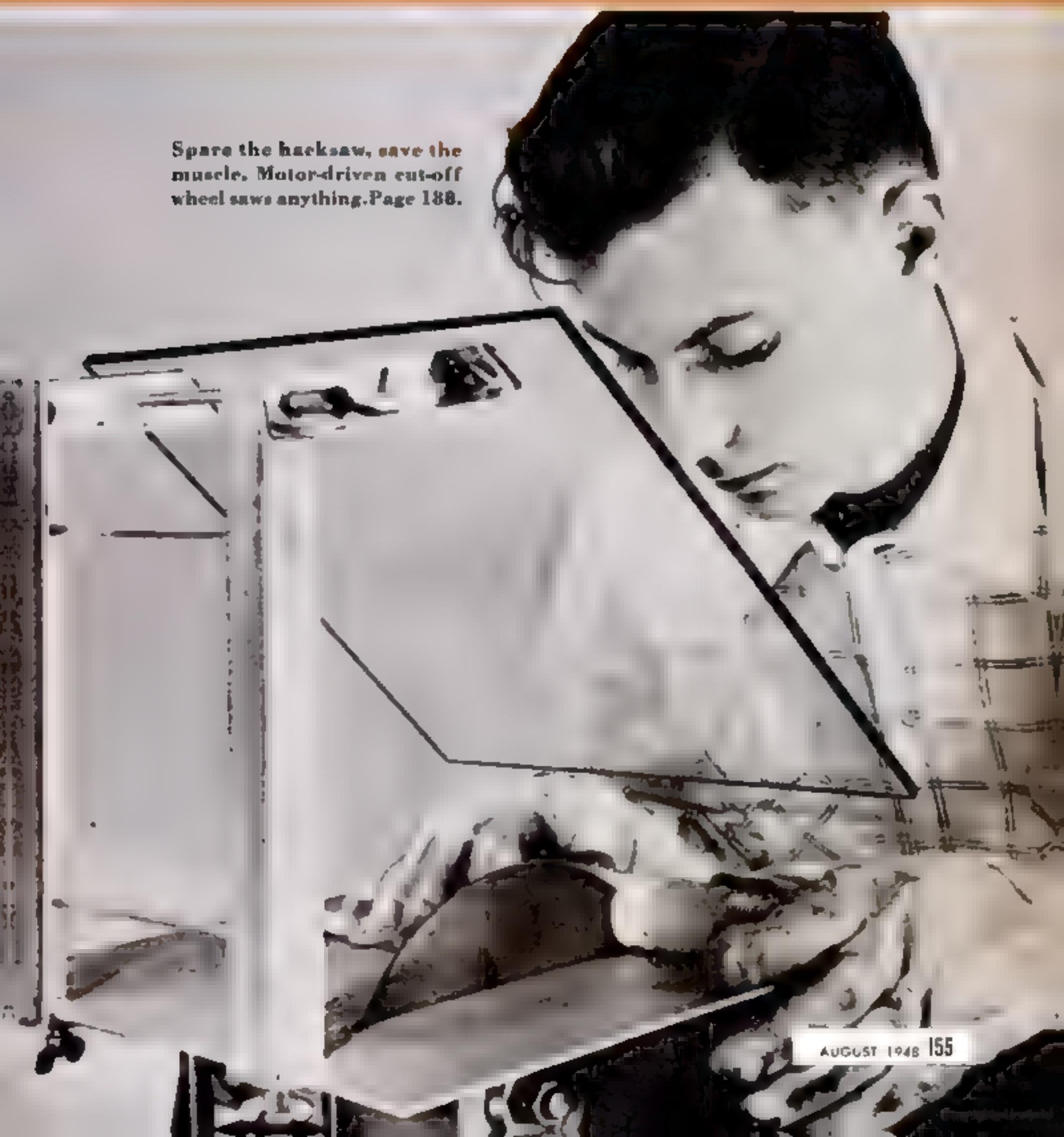
Building Your Own Enlarger

PAGE 195

Give Blind Radios a Tuning Eye

PAGE 201

Spare the hacksaw, save the
muscle. Motor-driven cut-off
wheel saws anything. Page 188.



Map Measurer Rolls Off the Miles

ROLLED along a map to follow curved highways or irregular small-boat courses, this measurer gives you the distance in inches that it's moved. Changing inches to miles is then just a quick calculation with the inch scale on the map. You could, of course, calibrate the gadget to read distance directly, on maps of the same scale. For accuracy, take three readings and average them.

As you see here, the measurer is strictly a kitchen-table project, made without recourse to a lathe or other power tools. A few hand tools are all you'll need. Also, it can be put together in one evening. The frame is from a 4" print roller costing 35 cents; the shaft is a machine screw; the roller, a common fiber washer.

Hacksaw off the rubber roller and replace it with a $\frac{3}{16}$ "-20 screw about $4\frac{1}{2}$ " long, held by three nuts. File down the frame ends and nuts to give maximum clearance. Find a hard fiber washer around $1\frac{1}{16}$ " in diameter, and check to find the exact distance



To use measurer, push it over the map on the route selected. Rolling wheel clocks distance.

it rolls in one revolution. (Mine rolled a precise $2\frac{1}{8}$ ".) Drill it $7/32$ " and turn it onto a $\frac{3}{16}$ "-20 screw, which will serve as a tap.

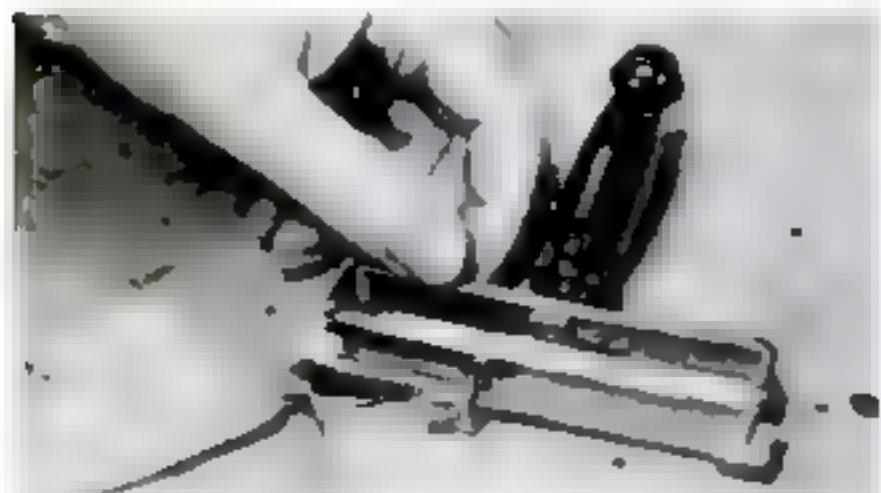
Mark off a paper scale that shows the number of turns the wheel makes; one that has an index line for each two revolutions ($1/10$ " for a 20 t.p.i. screw) will be satisfactory. Use transparent tape to attach the scale to a thin steel pocket rule, and screw it to the frame near the wheel. Mark a center line on the edge of the wheel, and mark the side of the wheel with a starting point and divisions equivalent to $\frac{1}{16}$ " travel, so distances can be read to less than one revolution.—Arthur Miller, Manhattan, N. Y.



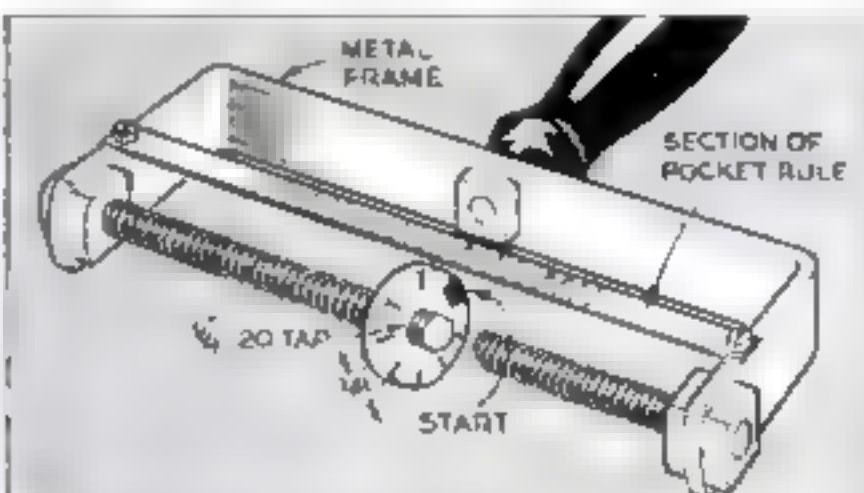
Remove the rubber squeegee from the frame by sawing through the metal shaft. Use a file to round off the corners of the nuts. Before tap-



ping the center of the washer, run a $7/32$ " drill through. The fiber washer can be tapped with a $\frac{3}{16}$ "-20 machine screw, as in the photo at right.



Ink a black line all around the fiber wheel in the center of the edge. Paint the sides white.



This drawing gives you construction details of the measurer. The scale is taped to a small rule.

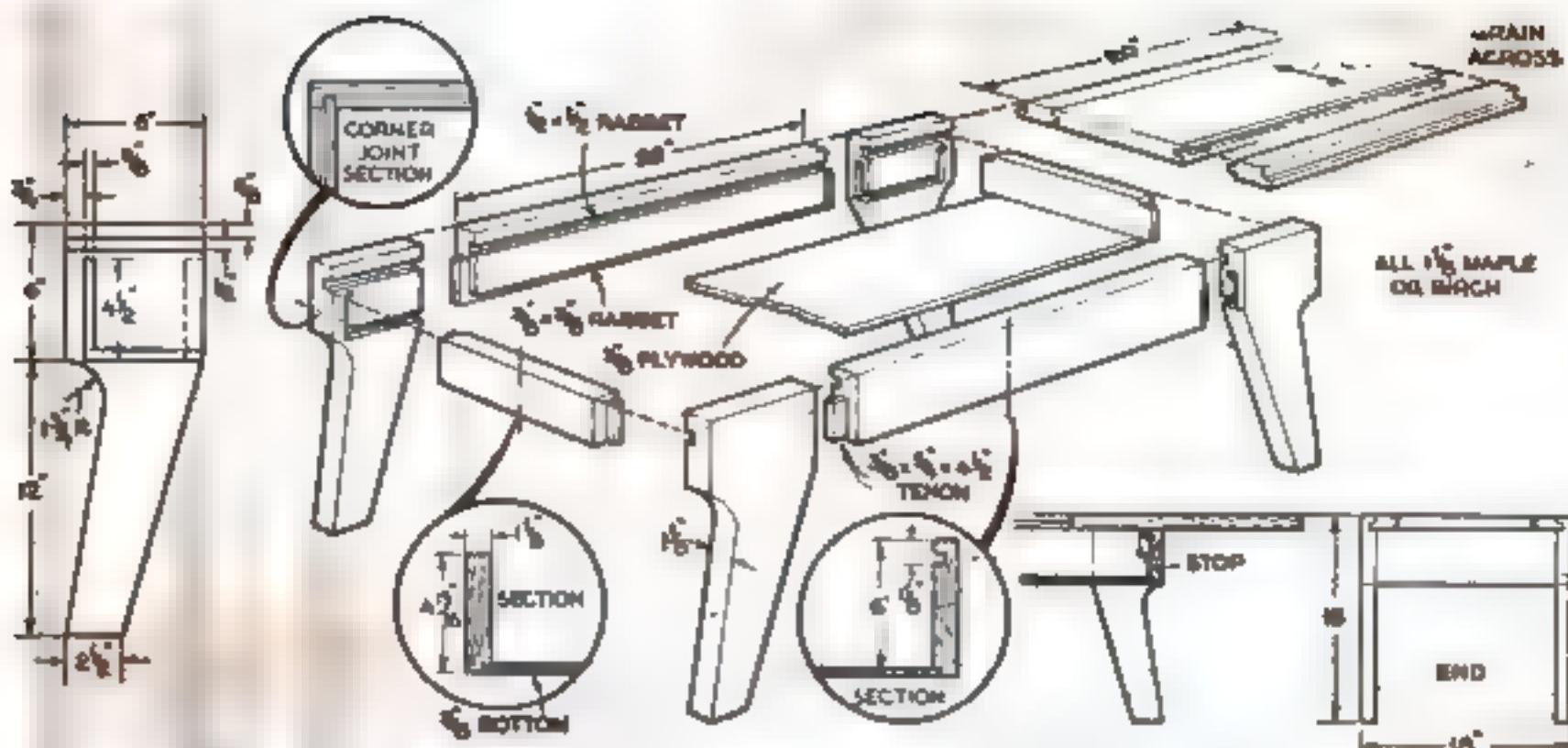


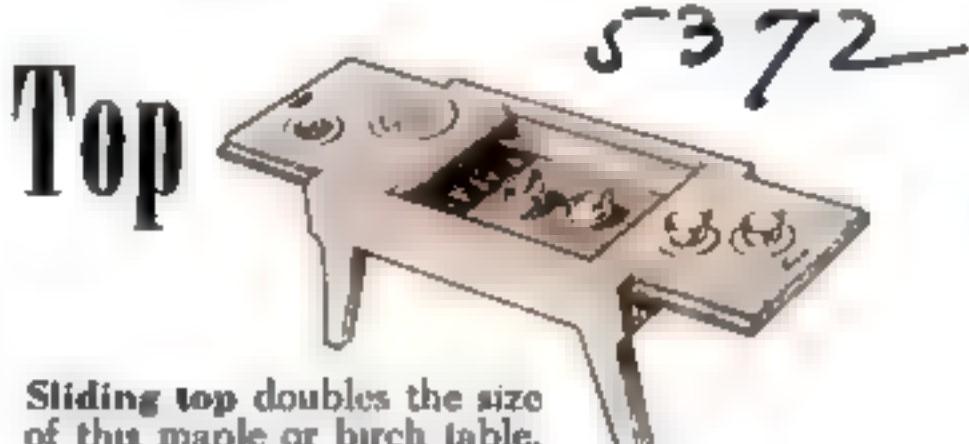
Table Has Sliding Top

TH E most important consideration in building this sliding-top coffee table is exactness. Accurate cutting and fitting are musts.

In the currently popular light maple or birch, this piece is an asset to any room. Sugar, cream, and sandwiches may be served from the compartment with cups and saucers on the extended leaves. The table nicely holds snack servings for six persons.

For the best appearance, $1\frac{1}{2}$ " stock is recommended, although a lighter wood may be used. Construction is pretty much a rabbeting and mortise-and-tenon job, with all joints glued. Shape the legs first, cutting the mortises and then joining them to the side members. After that, rabbet the slots in each unit for the sliding leaves. After gluing the joints, be sure to remove any excess that squeezes out. Otherwise, the finish will be spotty.

With the two side frames completed, join them with the cross members by mortise and tenon, as shown in the drawing. Sand



Sliding top doubles the size of the maple or birch table.

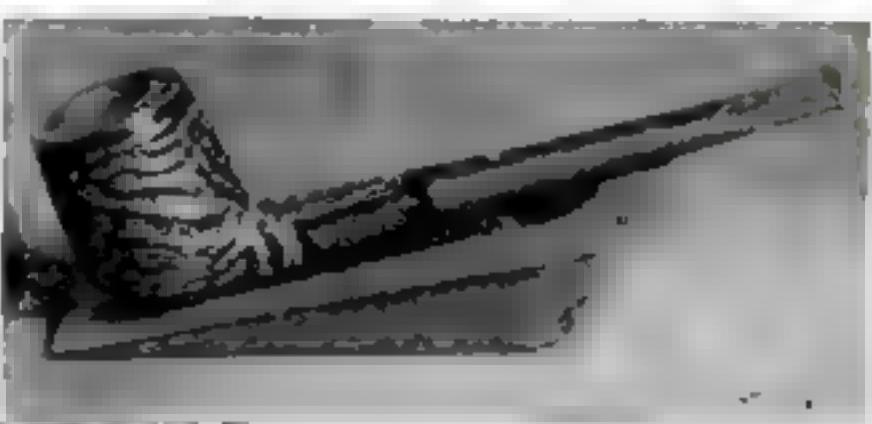
the slots for the sliding top until they are smooth. Then apply wax.

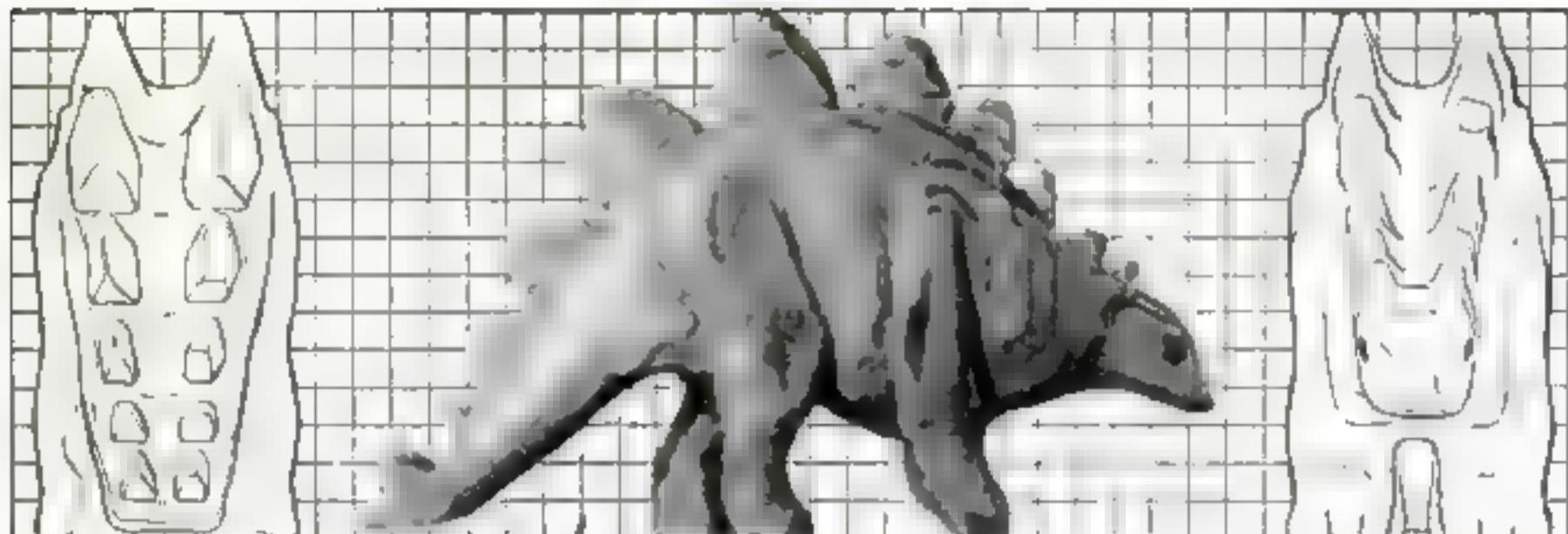
Each leaf is made up of three pieces, the middle piece with the grain crosswise and the side pieces with the grain lengthwise. Assembly is by tongue and groove. The lips that run in the slots should not be actually tight, and yet not too loose. Sand the lips carefully until they are smooth and allow at least $1/32$ " clearance between the lips and the slots so the parts will not bind.

Cut finger grips in the top end of each leaf and peg a dowel on the underside of each one as a stop. For the bottom, use $\frac{1}{8}$ " plywood and fasten it in place with glue and screws. You'll need about two dozen 1" No. 7 flathead wood screws. A shellac and wax finish will give the table a high, rich polish.—*Hi Sibley, Nuevo, Calif.*

Rubber Door Stop Used As Pipe Rack

A RUBBER doorstop, which can be purchased for about a dime, makes a handy rack for a pipe, as shown at the right. The stop may be used alone as a pipe rest, or it and an ash tray may be screwed to a wooden base.—*H. Klein, Pittsburgh, Pa.*





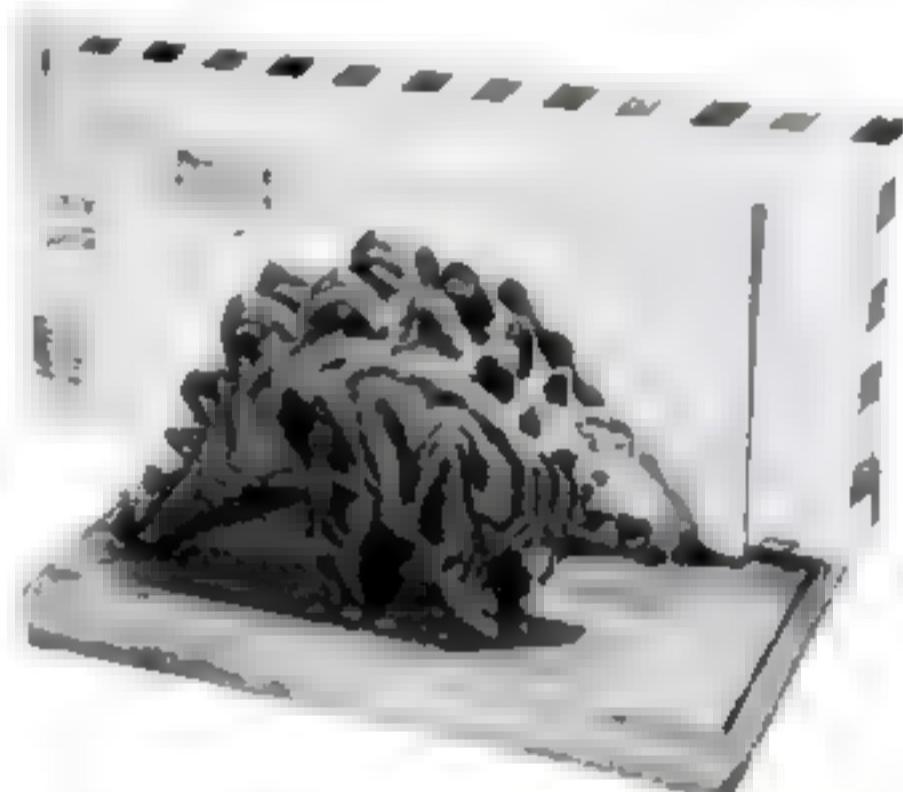
5363 *Desk Dinosaur Minds the Mail*

Here's another prehistoric horror, scaled down to a safe 3½" and mounted to decorate a letter rack.

This big lizard—a stegosaurus—was an early dinosaur. He exceeded a modern elephant in bulk. To give you an idea of his size, the largest of the spiny fins on his back was 3' high.

Lay out the pattern on 2" stock by tracing it on a grid of ½" squares. I used redwood but this breaks easily when carved into small projections such as the fins. You may prefer pine or basswood. Do the carving with a knife and carving chisels. Motor-driven burrs are helpful in cleaning out the surplus material between the fins and between the legs. However, you can do the job with just a knife.

Sand the figure well but do not destroy the carved planes. Put on the eyes, nostrils, and mouth with India ink and a pen. Redwood needs only a coat of shellac. Other



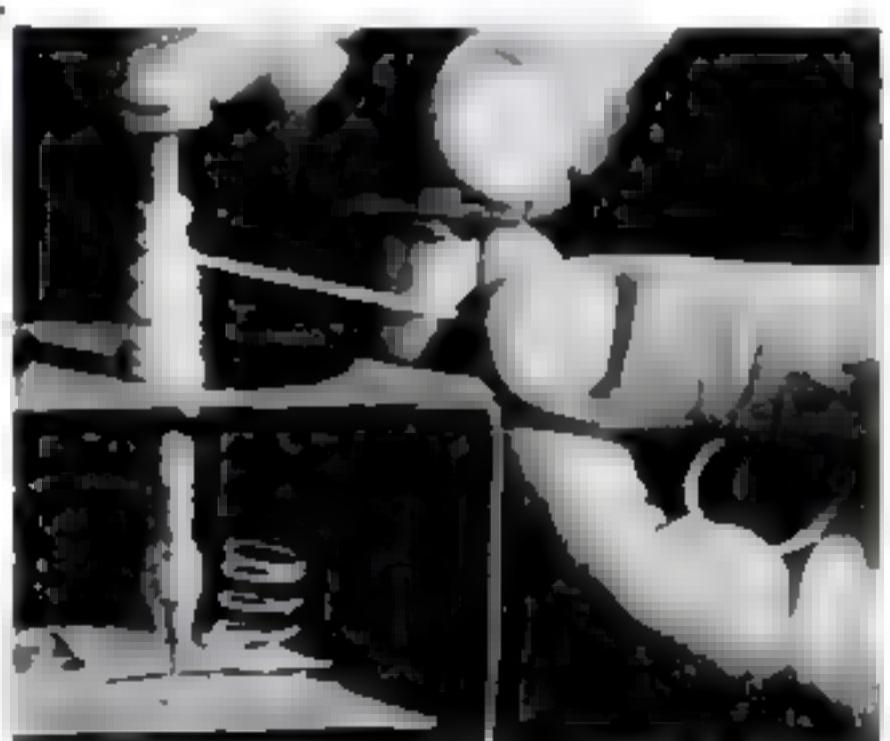
Either bevel the top edges of the base or use a shaper cutter to give it a decorative finish.

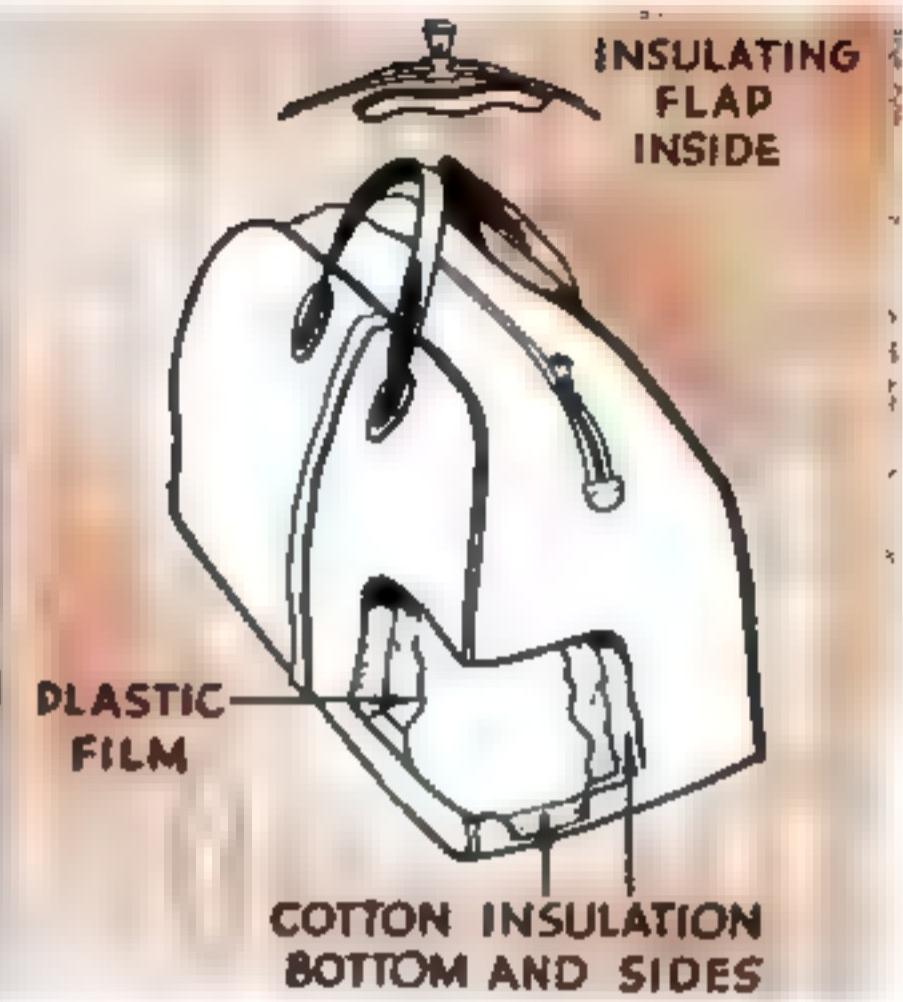
kinds of wood may be stained or painted.

The base is 5" by 7" hardwood ¾" thick. Bevel the top edges. At 1" and 2½" from the rear edge, cut blind dadoes ½" wide and ½" deep for two clear plastic sheets. These are ½" by 3½" by 5½". Cement them in place and mount the figure with glue and small screws.—Elma Waltner, Hurley, S. D.

5358 *Pin Vise and String Drill Holes in Tight Quarters*

NEXT time you want to drill a hole in a spot where there is barely enough room to move a hand, try winding a few feet of stout string around a pin vise. You'll also need a pad or button with a short shank to fit loosely into the hollow vise body. Apply pressure on the button as shown and pull the string. The efficiency of this dodge will surprise you. I've used it to drill through 1/16" thick brass with one pull of a 3' length of cord. Light fishing line will do fine.—Herbert Pfister, Bronx, N. Y.





This homemade beach-bag "icebox" will keep drinks cool, food fresh for as long as 16 hours.

Picnic Bag Keeps Food Cold *5302*

HERE'S what you need to make this lightweight, picnic refrigerator: A canvas beach bag, an ice bag, a pound roll of nonsterile cotton, and a plastic-film table-cloth cover.

Make paper patterns of the end, side, and bottom of the beach bag, cutting them about 1" larger all around. Cut enough cotton for three layers on each side and on the

bottom. Then cut two pieces of plastic for each side, end, and bottom.

Put three layers of cotton between each two pieces of plastic. Seal the edges of the plastic with an iron, pressing through a sheet of paper. Don't have the iron too hot, or the plastic may disintegrate. Stitch the insulating pieces in the bag. Finally, make an insulating strip to fit just beneath the zipper.

A tray of ice cubes in the ice bag will do for most purposes, though you can also use dry ice (solid carbon dioxide). But put it in a can that has holes punched in it; don't put dry ice in an ice bag and screw the cap on, since the gas released would rupture anything watertight. Use the bag also when shopping for frozen food.—F. Tobin, Chicago.



Make paper patterns of the sides and bottom of the bag. Then cut the cotton and plastic to fit.



When sealing the plastic sheets with an iron, cover the plastic with a piece of heavy paper.



Flock comes in many colors. It's made of fine rayon fibers cut to length and then dyed. You have a choice of two lengths—1-32" and 1-16".

Two colors may be mixed for an intermediate hue. For example, the pale blue above was made by mixing a quantity of white and dark blue.

1292 *Paint It with Rayon*

With dyed flock, you can give any surface a colorful, velvety finish.

PHONOGRAPHS turntables aren't natural-ly fur bearing. That velvetylike surface on them is a finish called flock. It consists

Here's how it's done. Because the cabinet had been damaged and rather poorly repaired, it was decided to apply flock. Cleaning with a solvent was the first step. Porous surfaces

of tiny lots of fibers—some 250,000 to a square inch standing on end in a coating of adhesive.

Flock finishing is now within the reach of any craftsman. Kits are available containing everything needed—a special spray gun,

should be sealed with shellac. Then a thin coat of undercoat adhesive, the same color as the flock, was applied evenly and allowed to become tacky. Next, flock was put on the gun





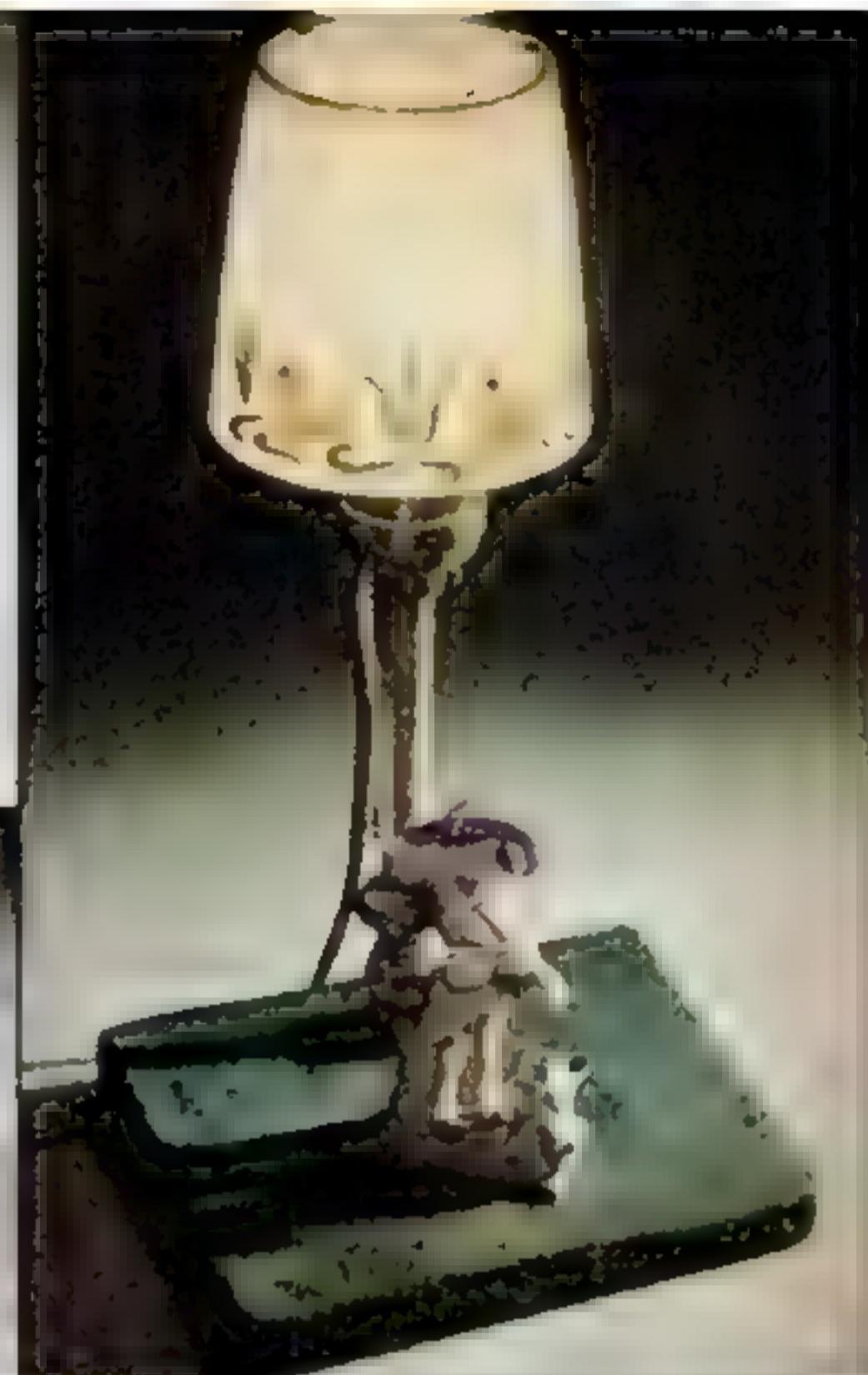
A flock lining does the job of velvet in this jewel box. Outside, it's just for decoration. On the curving, it adds lifelike texture.

adhesive undercoat, thinner for the latter, and a supply of flock in various colors.

To use it, you first brush on a thin coating of the adhesive. Like the flock, this undercoat comes in different colors. Unless you want an unusual effect, the two colors should be matched. When the adhesive is tacky, the flock is sprayed on.

You can apply flock as padding under such projects as ash trays or book ends, and

Flock was sprayed on vigorously from 4" to 6" away. Ordinarily the gun should be at right angles to the surface (Below, it was tilted to blow flock into the louvers.) Overspray is

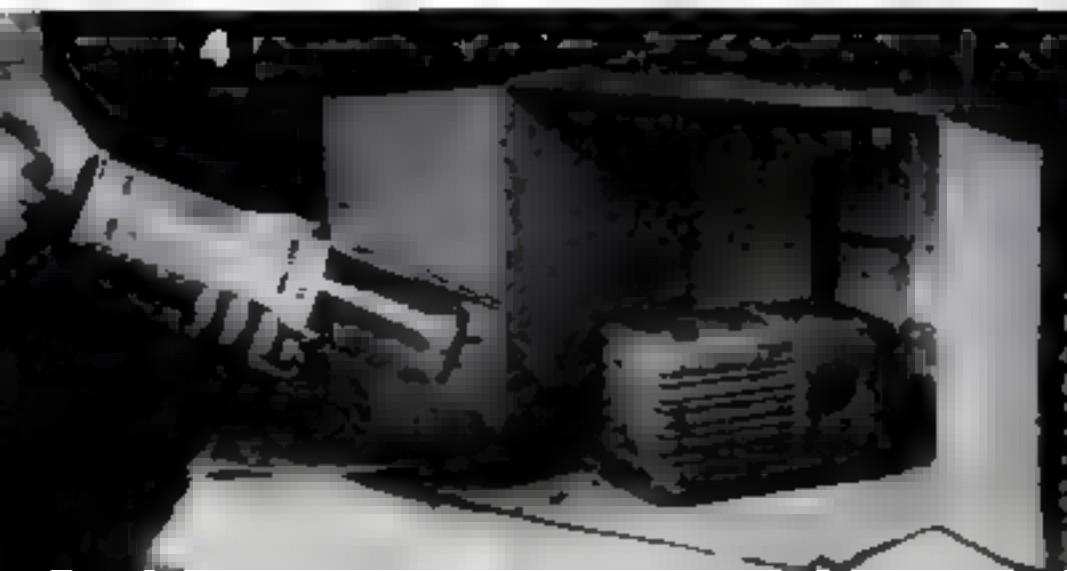


A crack in the plaster base of this lamp was still conspicuous after being cemented. Flock hid it. The shade decorations are also flock.

as a lining in a jewel box. If you make model furniture, flock would enable you to "upholster" each piece. Similarly, it could be used as "fur" on toy or model animals.

If you wish, the material may be used as pure decoration. The lamp shade above is an example. Here the pattern was painted with undercoater and the flock then sprayed on. Novelty greeting cards are another possibility with this technique.

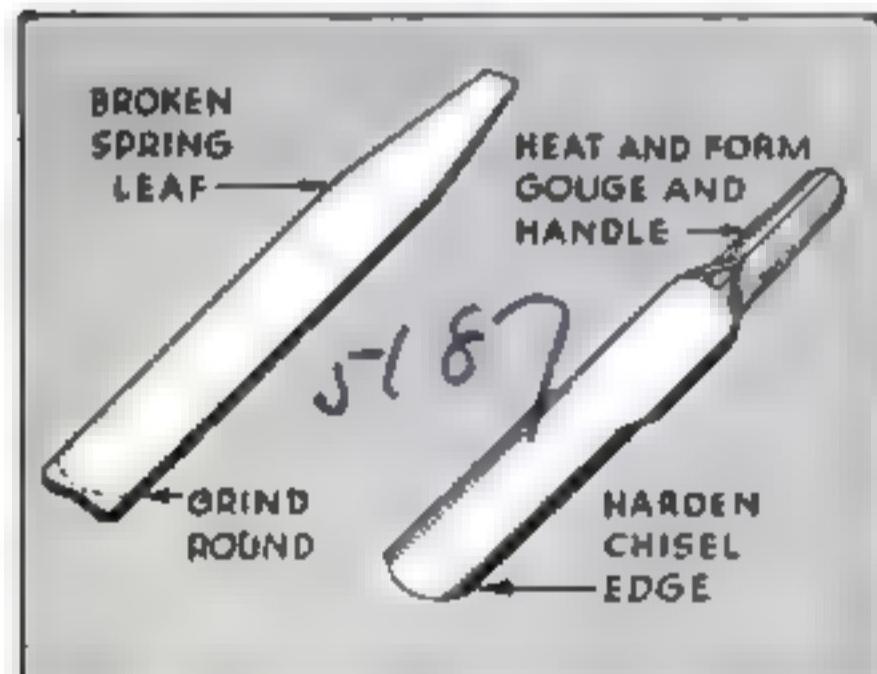
caught by placing the work in an open carton. This can then be gathered up and reused. After the coating has dried 10 to 15 hours, remove loose flock with a very soft brush.





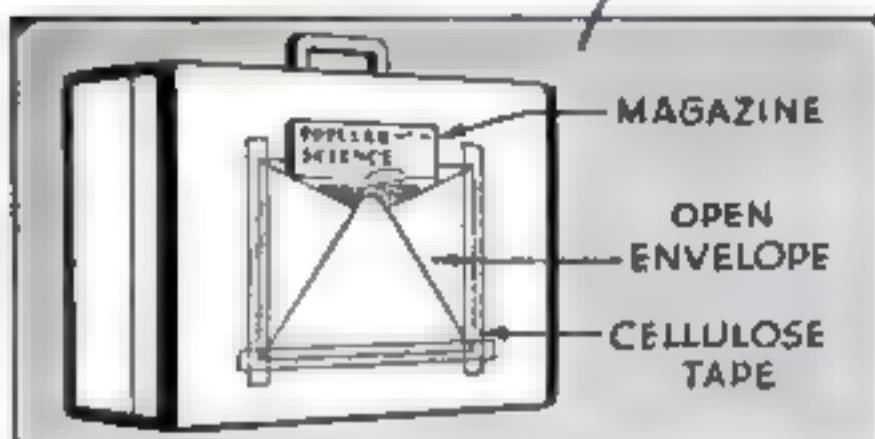
Ball-Point Pen Makes Stylus

AN EMPTY ball pen or cartridge—the type with the ball built in—is worth keeping as a smooth-acting, round-point stylus. Craftsmen can emboss leather or metal foil with it, as above. It's also fine for drawing on duplicating stencils. Used with carbon paper, it makes dark, clear copies without smudging the original lines as a pencil will.



Big Chisel Forged from Spring

A KEEN, durable chisel, especially good for tree surgery, may be made from a broken auto spring leaf. Grind the broken end to the desired shape. Then in a forge or furnace soften the metal for blacksmithing into a gouge contour. At the other end of the spring section, roll the edges together to form a suitable shank for hammering. Before rehardening, rough-grind the chisel edge. Hone it sharp after hardening. Leave the rolled end soft.—E. F. Lindsley, North Prairie, Wis.

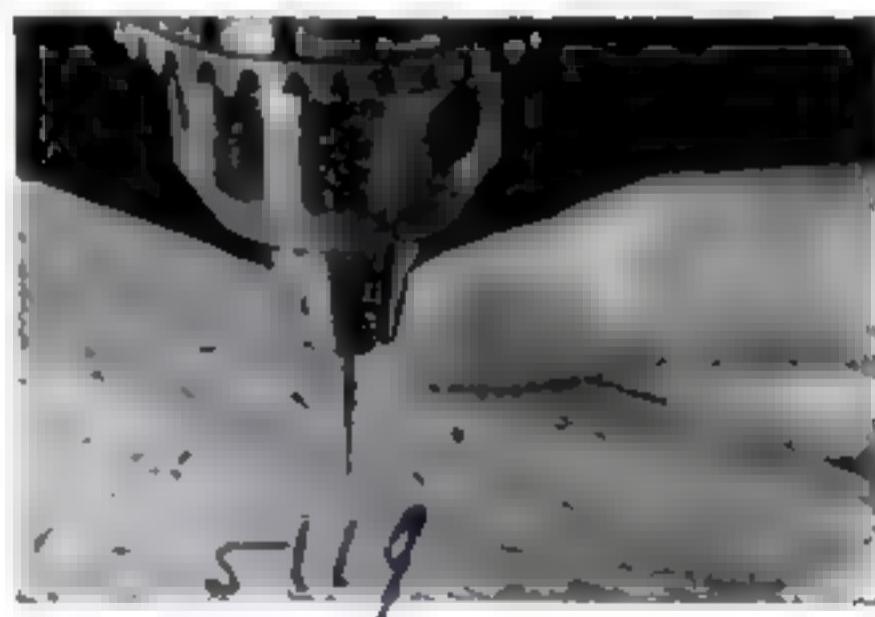


Envelope Holds Magazine

DO YOU ever hesitate to buy a magazine as you rushed for a train because you already had your hands full with bags and a coat? A large Manila envelope, taped to the side of your bag, makes a fine emergency carrier for a book or magazine. You can buy the envelope in any stationery store. Simply tear off the flap and use cellulose tape to hold it to the side of the bag.—Rudolph Malkin, Syracuse, N. Y.

Cord Has Soft Rubber Plugs

AN EXTENSION cord set with an unbreakable, three-way plug and attachment plug of soft rubber has been announced by the United States Rubber Company. Intended for general household use, the set is produced in lengths of 6', 8', and 15' of No. 18 rubber-insulated wire.



Worm Holes Produced by Burr

WORM holes add an authentic air to antique copies. A discarded dentist's burr, in a chuck turning at 3,500 r.p.m. or faster, will produce realistic ones. Vary depth and direction as shown.—Reginald O. Lissaman, Brandon, Man.



*Popular Science
Practical Solution*

5-236

Typing Table Has Built-in Wastebasket

Two things that go together like ham and eggs are a typewriter and a wastebasket. Whether you're a professional writer or whether you just use your typewriter for occasional correspondence, you'll still need a wastebasket nearby.

The combination pictured above is another practical solution devised by the Editor for his own use. The typing stand is lightweight, yet steady. It slides easily over floors or carpeting, although there are no casters on it. Instead, there is a glider

in each lower corner. The compact unit is small enough to be slipped into a closet or little-used corner for storage.

The top, butted against the back and the two sides, was dimensioned for one of the smaller portable typewriters. It may have to be bigger to fit yours. Butt joints were used throughout, and the pieces—all $\frac{3}{4}$ " pine—were assembled with No. 8 $1\frac{1}{2}$ " wood screws and glue. Sand the wood smooth and finish it to harmonize with the color scheme of the room where it will be used.

Thumb Indexing Phone Book with Engraving Tool



With an electric engraving tool of the vibrator type you can thumb-index phone books, catalogs, and other volumes.

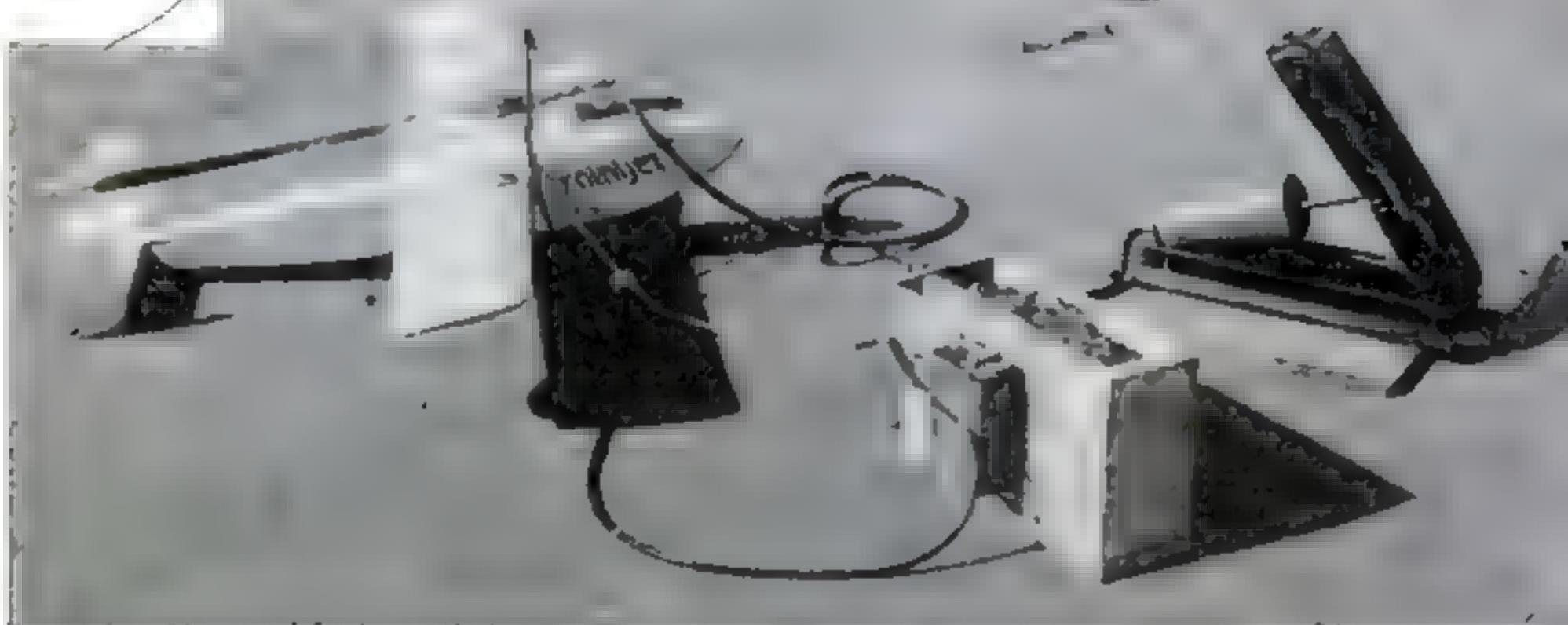
Decide how many notches are required. Then measure the long edge and divide it for the needed number. Cut the notches in the pages preceding each letter. For instance, turn to the start of the A's. Lay a piece of thin wood on that page, turn back the preceding pages, and cut the notch.

To index with two rows of notches, one facing left and the other right from the center of a book: Cut the left hand notches in pages following the letters and the right-hand notches in pages preceding the letters. An unabridged dictionary is a good model.

Use a wood-carving bit or a half-round gouge. Hold it at a 25-deg. angle for the initial cut, more upright in finishing the notch.

4019

"Dyna-Jet
Kits"



Starting setup for a jet model includes pump at right for compressed air and Ford coil for

continuous, high-tension current to spark plug. Lines are removed after jet has been started.

Model Jet Planes

Top 140 m.p.h. ^{so far}

Pulse jets find increased favor with modelers as experimenters work bugs out of war-developed power plants.

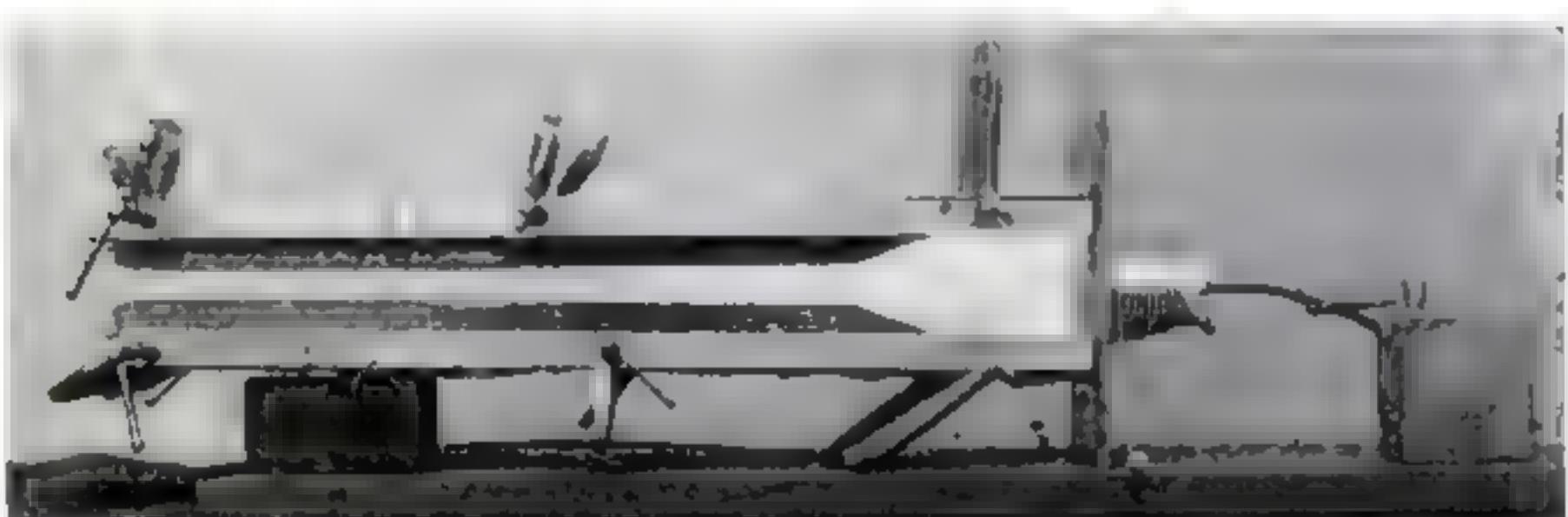
By J. H. Lemelson, ⁷² Prescott Ave., Staten Island, N.Y.
and R. F. Probstain

MODEL builders are switching to jets. In increasing numbers, enthusiasts are fitting miniature planes, boats, and racing cars with small jet engines—the same

type that powered the Nazi buzz bombs.

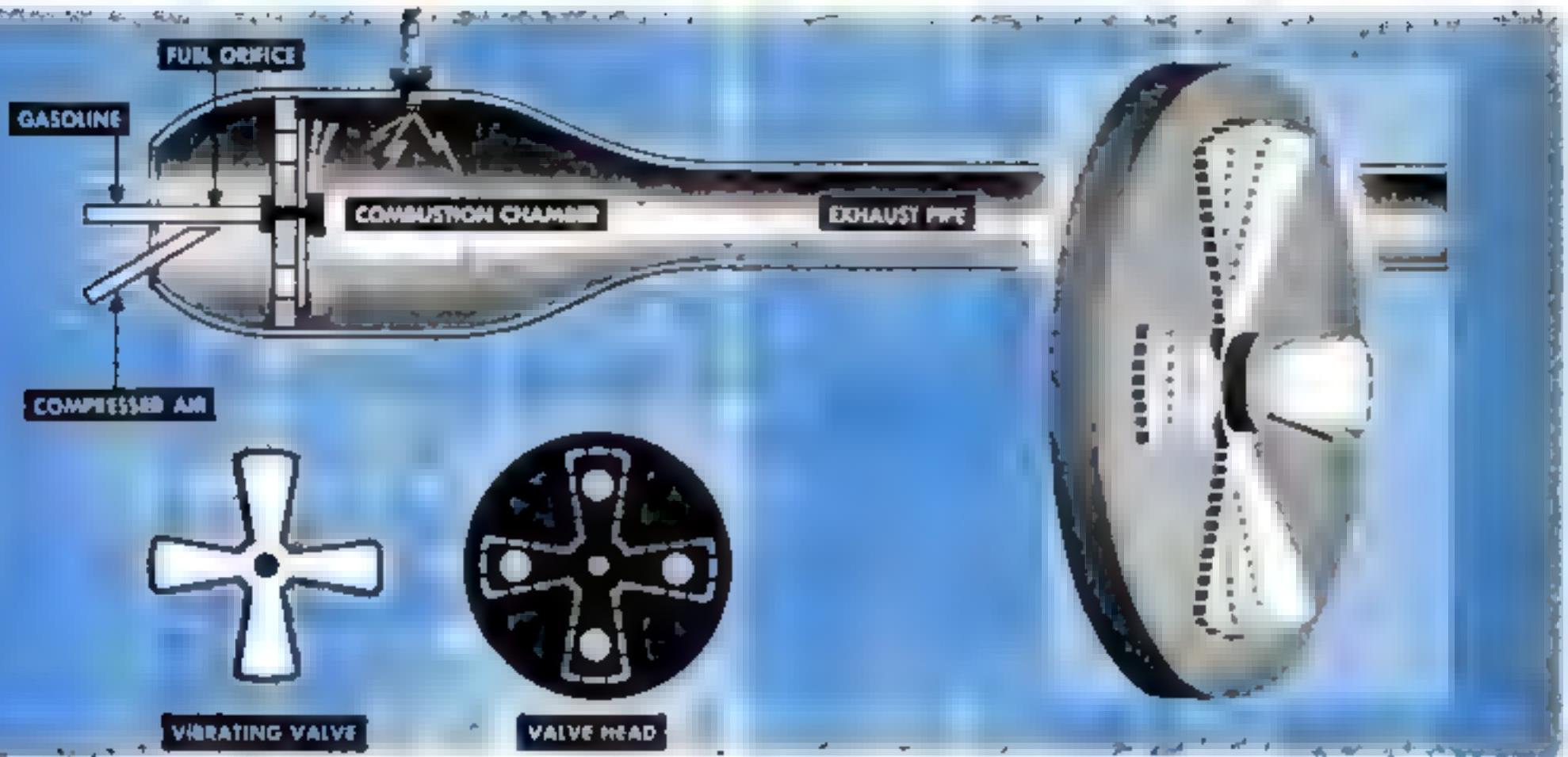
These little power plants measure less than 2' long and are from 2" to 3" in diameter. They weigh about a pound and develop more than 4 lb. of thrust, enough to whiz a model plane along at speeds well over 100 m.p.h. In fact, the Academy of Model Aeronautics officially clocked one at 141.07 m.p.h.

This type of engine is known as the pulse jet or intermittent jet. It also has been



High-speed cameras record explosion characteristics of this glass-walled jet at New York

University School of Engineering. Model has short life since heat cracks walls after 30 seconds.



Parts of a pulse-jet engine are shown here. As each explosion blasts gas from exhaust pipe,

valve is sucked open to admit air and fuel for following explosion. Valve is sole moving part.

tagged with such names as buzz jet, resojet, and aeroresonator. The principle on which it works is fairly simple. Air is ducted through the inlet valve to the combustion chamber. An elementary carburetor vaporizes the fuel. The only moving part is a petal-type valve that opens and closes with each explosion. Combustion chamber and exhaust pipe are heat-resistant steel, about .015" thick.

Compressed air and a spark plug are used for starting. After the engine begins to fire, combustion is self-sustaining and the lines to the air vent and plug are disconnected. Thrust is created by a series of rapid explosions, about 250 per second. The result is a steady push. In contrast, the turbojet and rocket develop thrust by a continuous flow of combustion gases.

For power comparison, a model gas engine developing 1 hp. at 100 m.p.h. with 75 percent prop efficiency exerts about 2.8 lb. of thrust. A small jet engine at the same speed exerts around 4 lb. of thrust.

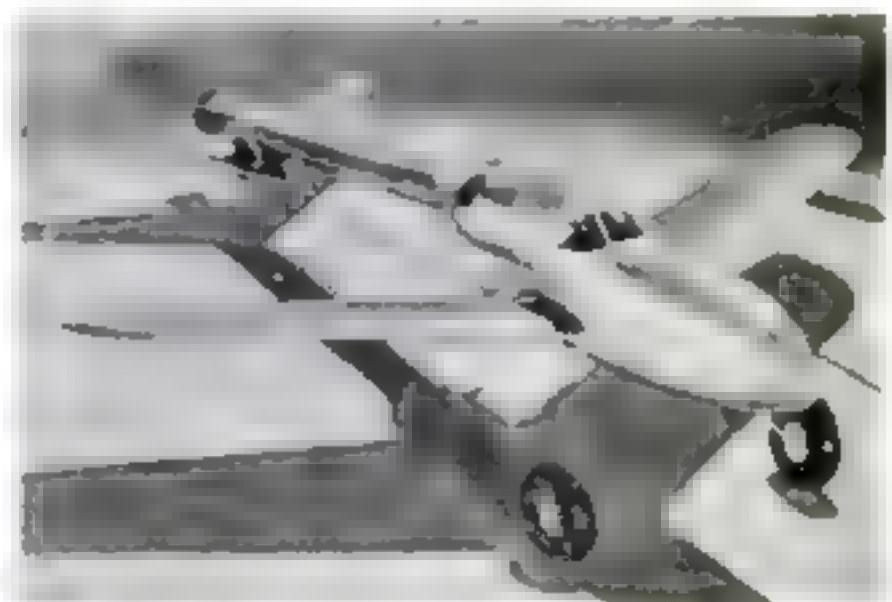
Model jet planes are flown in a circle at the end of 60' to 70' control wires. The planes, with wingspreads up to 4', carry 4 to 7 oz. of nonleaded gasoline, enough for 30 to 40 laps.

Besides planes, other jet-driven models include boats, automobiles, and iceboats. One of the latter was timed at 129 m.p.h. and a car at 125 m.p.h.

A few modelers began using jets shortly after the war. The first models were both troublesome to start and to keep running. Improvements since then have provided a fairly reliable engine. One manufacturer of



Model of Bell XS-1 experimental plane with jet mounted inside fuselage. Dolly is for take-off.



Engine built as rear of fuselage with exhaust pipe as tail boom. Elevator rod is below tube.



Engine is mounted internally in this model. Tanks on wings are dummies. Speed is 112 m.p.h.

kits claims a finely perfected fuel system—so finely perfected that the jet engine may be stopped and started while in flight. The manufacturer says the engine is stopped by pulling the model up into a stall. At a speed above 90 m.p.h., the engine will start again when the model is returned to level flight. The stall disturbs the air flow into the combustion chamber. Level flight forces fuel and air into the chamber, where the heat restarts combustion.

Four persons usually make up the starting team for a model jet. One man holds the model, keeping his hands well away from the tailpipe and combustion chamber. As the engine begins to fire these parts heat up to a bright red. However, once the model is in motion, the flow of air cools the engine. A second man handles the ignition; a third the compressed air; and the fourth acts as pilot, holding the control wires. Starting is characterized by a low purr that soon mounts to a loud roar.

Crashes occur occasionally. When they



A twin-engined job with gas tanks slung under each jet engine. Fuselage and wings are balsa.

do, the model usually is smashed beyond repair. Sometimes the engine, which sells for about \$35, is salvageable. At a recent meet, one of the jet planes crashed a heavy, fine-mesh wire fence. The balsa wings and fuselage were shredded to snowflake-like bits as the model rammed through the fence. The engine, badly damaged, remained on the other side of the fence. END



This jet racer is of cast aluminum, 22½" long. Car runs on tracks, topped 125 m.p.h. in test.

Jet power is being adapted to speedboats, too. This model now is undergoing performance tests.

Whatnot Shelf Lighted from Below

KNICKKNACKS, especially glass objects, are displayed effectively on this fluorescent-lighted shelf.

The dimensions in the drawing are for a 14-watt lamp. However, by simply increasing the length, a 15- or 20-watt lamp may be used. The stock is $\frac{3}{4}$ " white pine.

The top of the shelf is a 4" strip of single-weight window-glass, ground on one side to diffuse the light. Lay the glass on a newspaper. Sprinkle on it about $\frac{1}{2}$ teaspoon of abrasive powder such as No. 120 silicon carbide. Add a little water. Rub this mixture with a fragment of grinding wheel held flat, or with another piece of glass. Use a circular motion. In a few minutes you'll have a frosted surface on the glass.

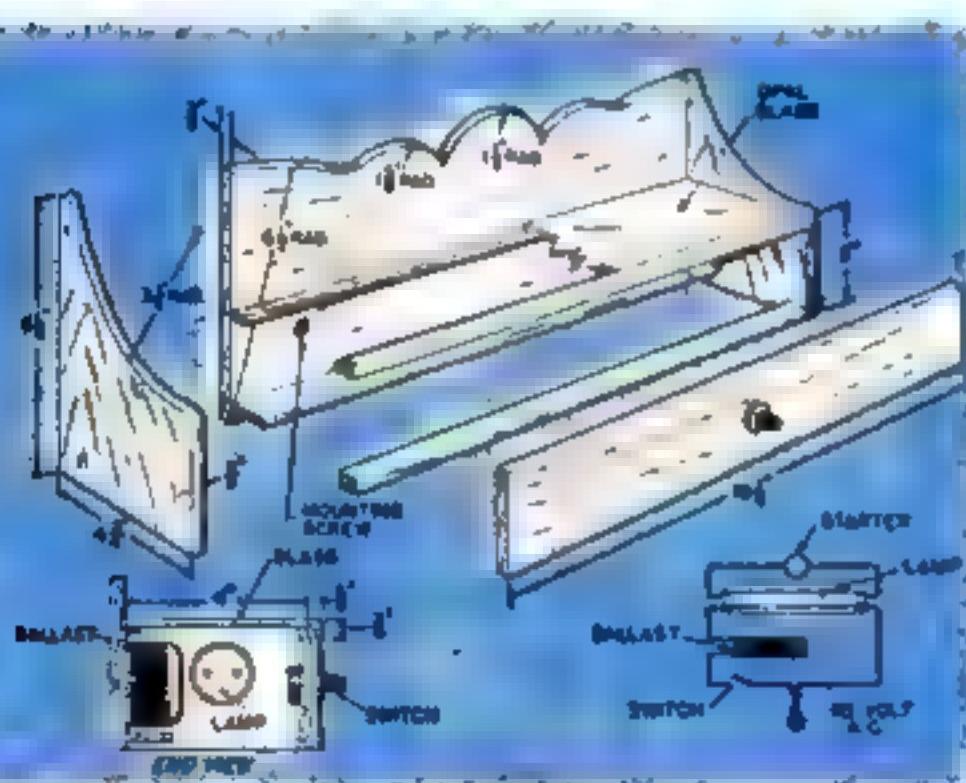
Fasten the wooden parts together with glue and brads. Set the nail heads deeply



Above with light above and below, the shelf is a focal point of interest in a room at night.

and fill the holes with composition wood. The front panel, which resembles a drawer, is made by assembling three pieces of wood as shown, or by framing a single piece.

Mount the ballast unit on the back panel just below the glass. The sockets go on the back panel also, as shown in a photograph. Give the completed shelf a coat of antique maple stain, followed by shellac and wax.—Walter E. Burton, Akron, O.



Back panel of the shelf is laid out with compass curves that are faired together freehand.

Ballast and sockets are mounted on the back. Center-mounted switch resembles a drawer pull.

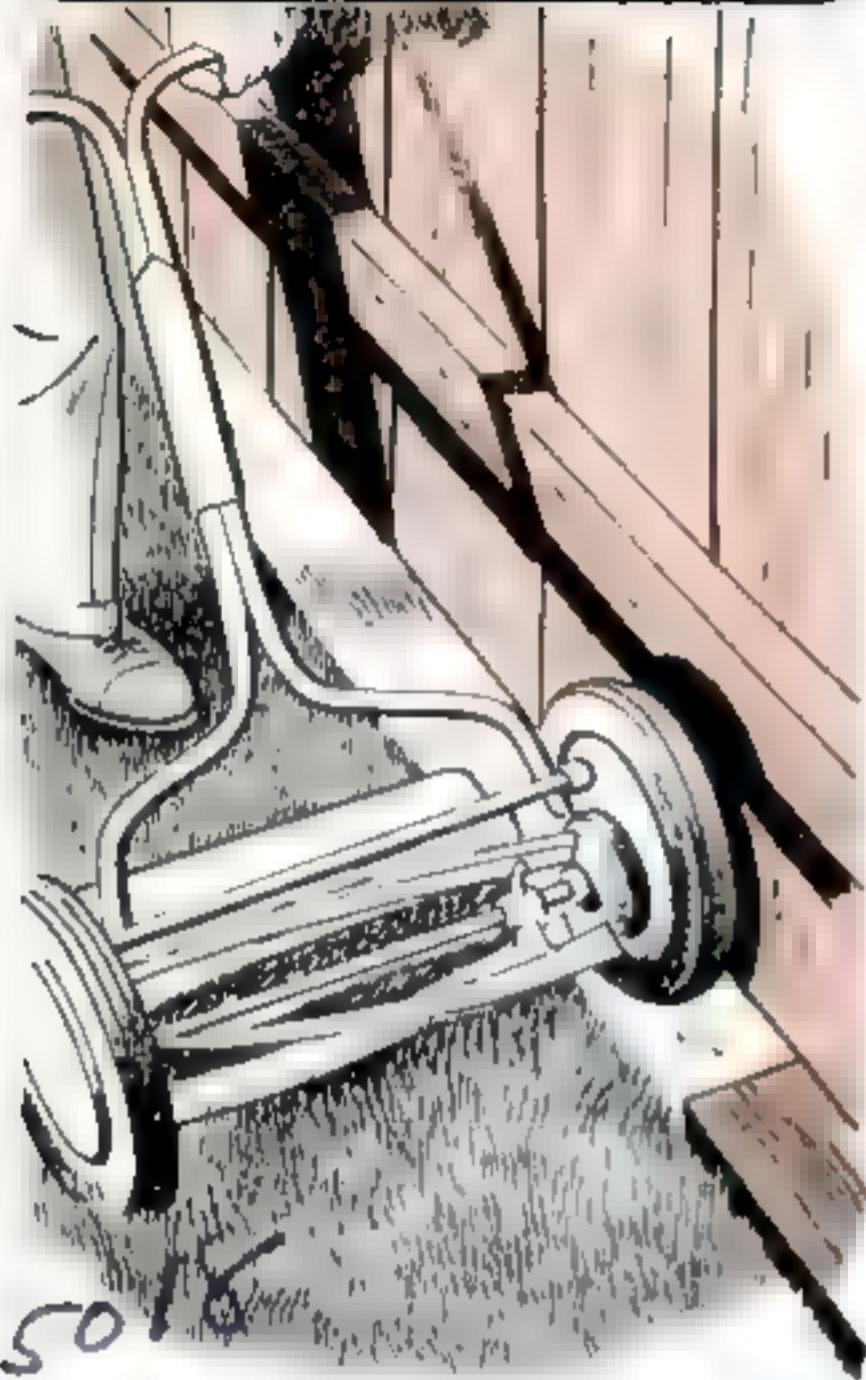


Round the edges with a knife or other tool and then sand smooth with an abrasive-cloth strip.

You can make ground glass if need be. Use abrasive grains, water and old abrasive wheel.



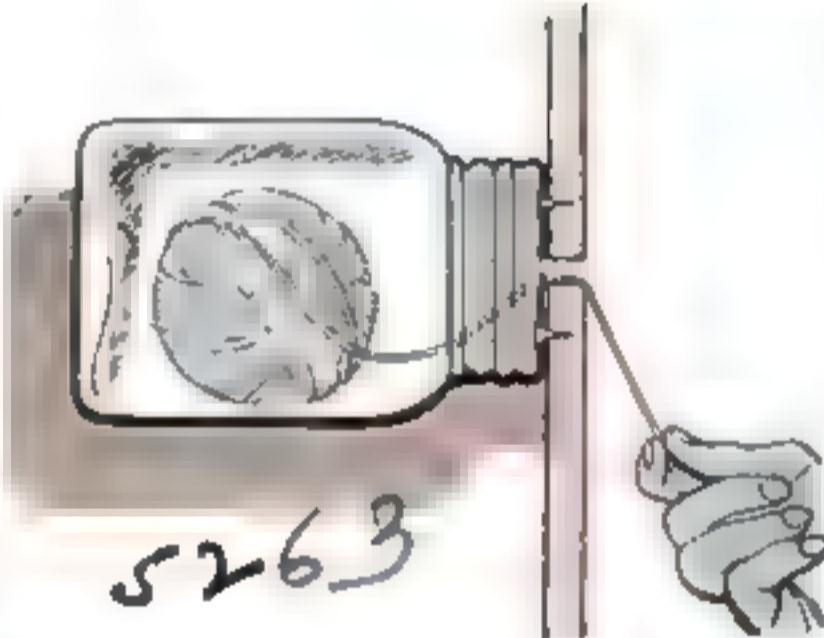
Keeping the Home Shipshape



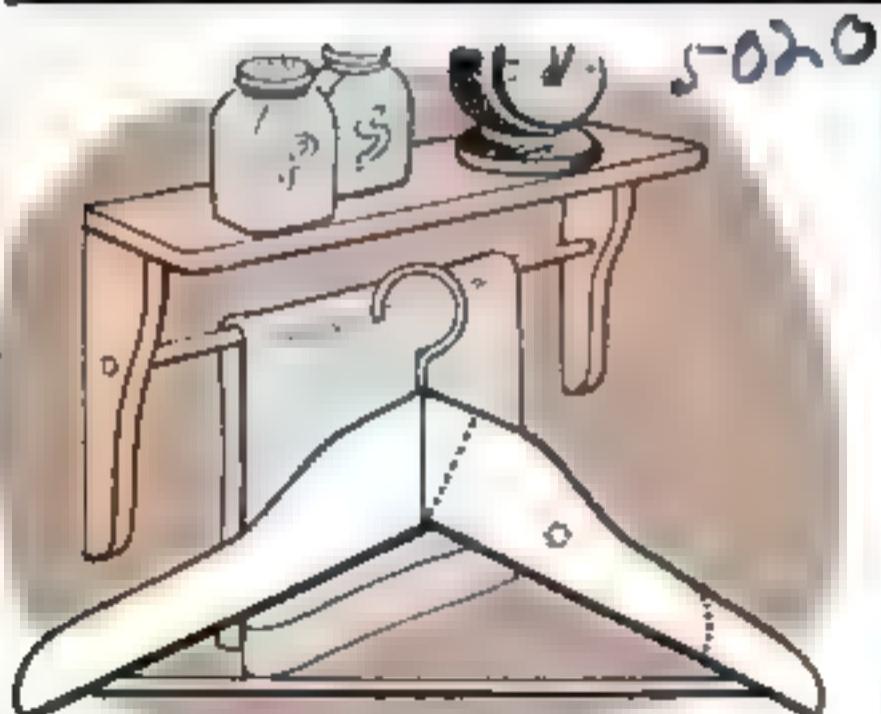
501
Eliminate tedious trimming close to a fence by keeping long, narrow boards under it to stop the growth of grass there. Replace them after using the lawn mower.



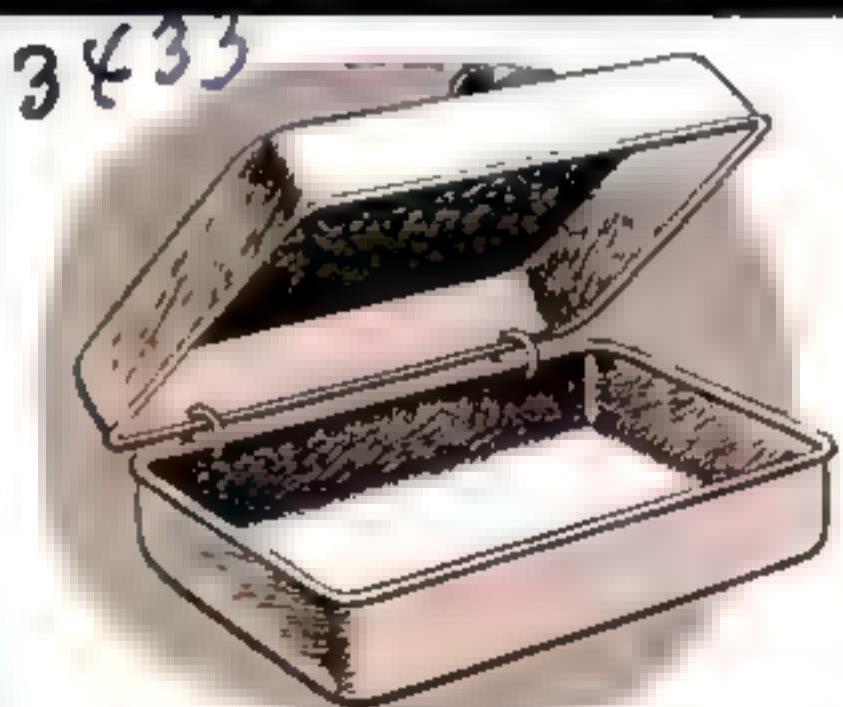
4299
When lifting stoves, metal cabinets, or other heavy objects that may have sharp edges, pieces of old garden hose will protect your hands. Slip the hose sections and slip them on.



5263
With this holder, you won't have to look for the ball of twine when you need it. Bore a $\frac{1}{4}$ " hole in a shelf support or cupboard wall. Two screws will hold on the jar top.



5020
Brackets for this small kitchen shelf are cut from a single wooden coat hanger. The top is a piece of $\frac{1}{4}$ " plywood. Drill holes for screws and for the dowel and finish with enamel.



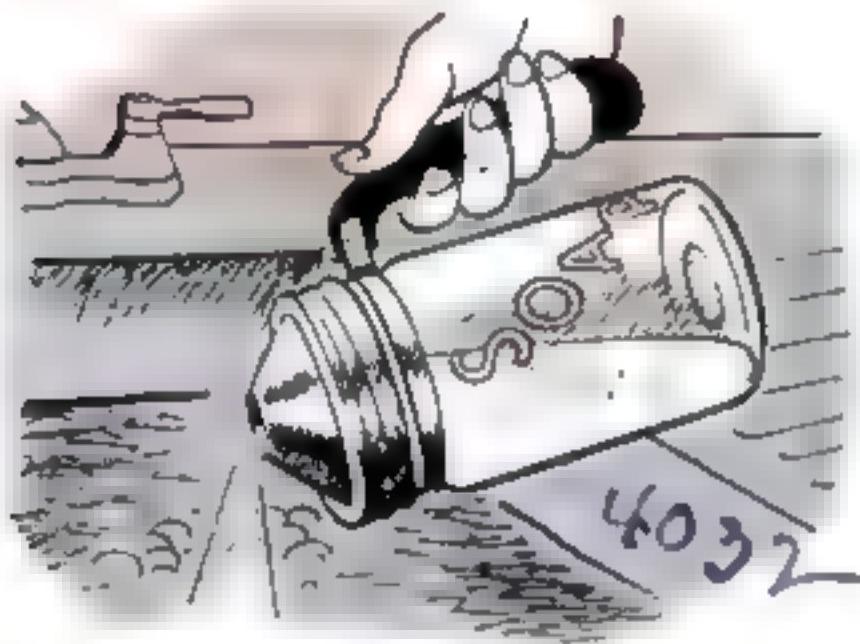
3433
Two baking pans hinged together along one side provide a fine steamer for a few ears of sweet corn. Fasten a knob on an upper edge of one pan, and don't use too much water.



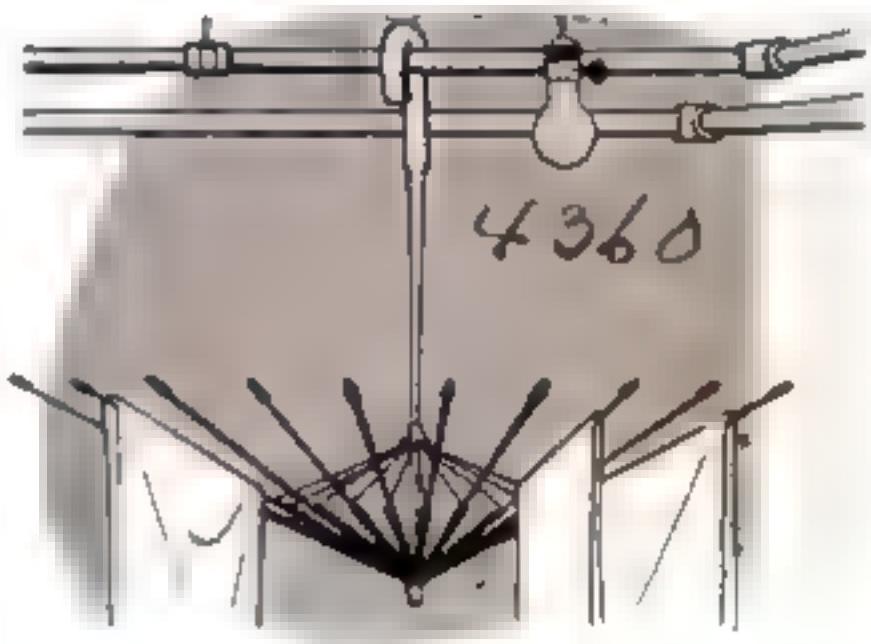
If your toaster gets away from you, try salvaging the remains with an ordinary grater. Hold the grater under the toast so the burned crumbs won't fall back on the slice.



A small cork makes a handy work-bag carrier for a thimble and a scissors. The thimble is easier to find and your fingers are protected against injury by the scissors' points.



A kitchen dispenser for powdered soap can be made from a fruit jar, a metal strap, and a coffee-maker handle. Cut the top off a beer can for the dispenser's top. Letter the jar.



An old umbrella makes a good rack for drying clothes in crowded quarters indoors. Strip off the fabric, open the umbrella, and hang it by the handle. It stows away in a small space.



Clothespins can be kept conveniently at hand in a box that rides along the line on small

pulleys. Drill several holes in the bottom of the box so that rainwater won't collect inside.



AIDS TO
MODERN LIVING

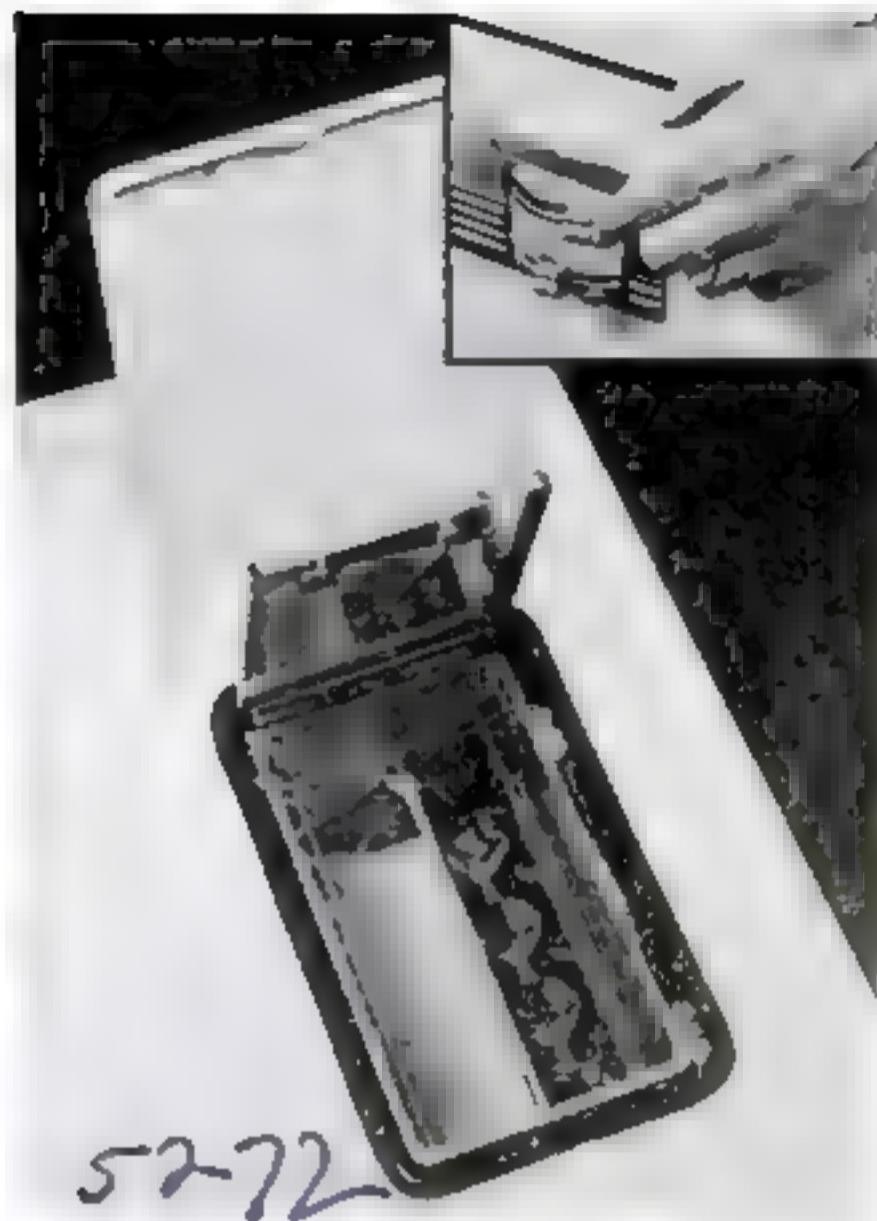
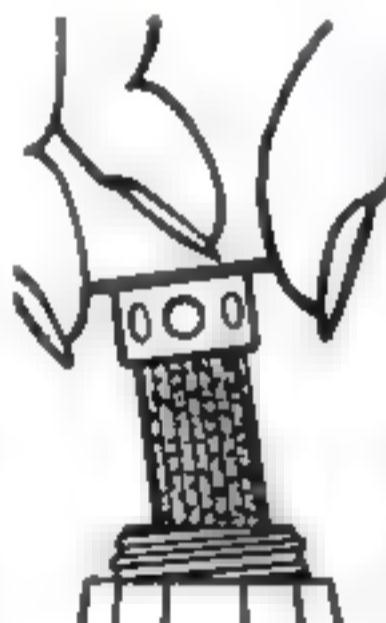


Squeezer Is Mixer Too. The Juice-A-Shake © combines squeezing, straining, and shaking in one compact unit. It may be used to make orange juice, milk shakes, or cocktails. Eggs also may be prepared for scrambling or cream whipped in the three-piece plastic juicer. It is available in four color combinations and is offered by the Kerel Products Company, Bronx, N. Y., at a retail price of \$5.

Keeps Salt Dry.

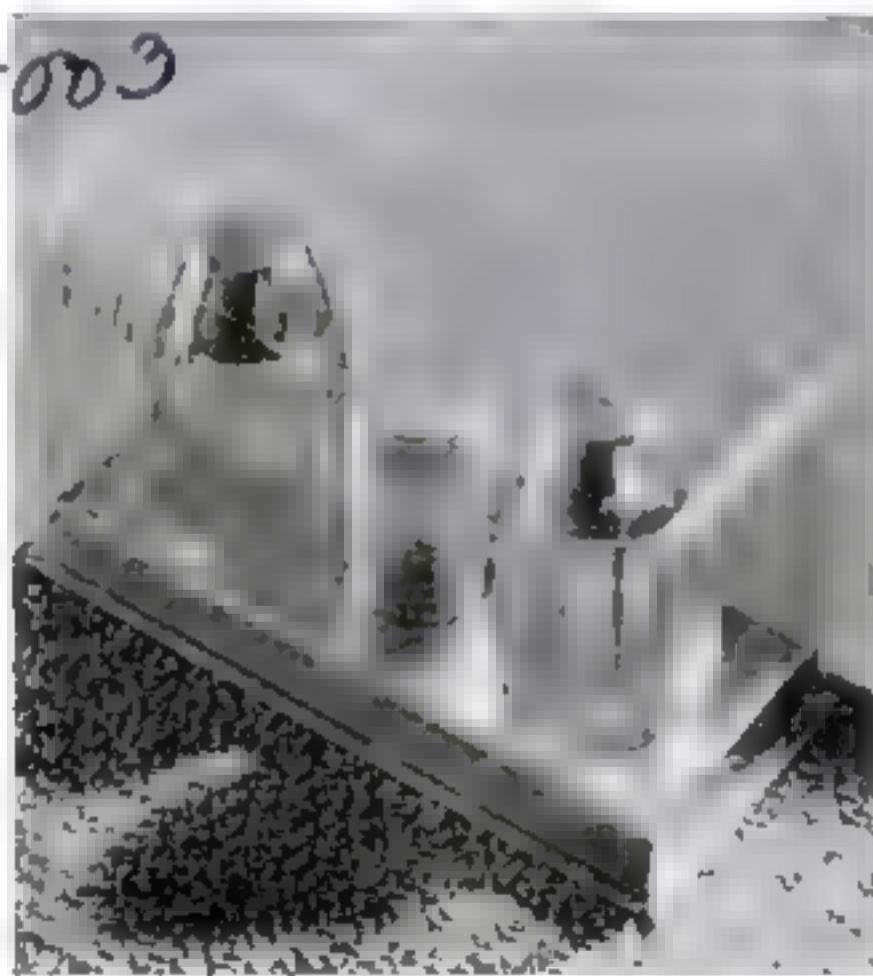
In damp weather, you don't have to bang this shaker on the table to get salt out. A drying unit, shown in the drawing, contains silica gel—a highly absorbent substance. After several weeks use, the gel gradually changes color from blue to pink as it absorbs moisture.

The unit is reactivated by putting it in a moderately hot oven. Meanwhile, a spare drying unit may be used. The salteellar with matching pepper container, is made by J. H. Young Co., Pittsburgh, to sell for about \$6.50.



Soap Automatically Injected.

With some new models of Bendix washers, a housewife merely loads it with soap powder, detergent, or water softener, sets the timer, and forgets about it. At the correct moment in the washing cycle, the powder is fed into the tub by the screw visible in the bottom of the compartment. The agitator, a rotating wire reel, sends a constant supply of soap to the feeder screw.



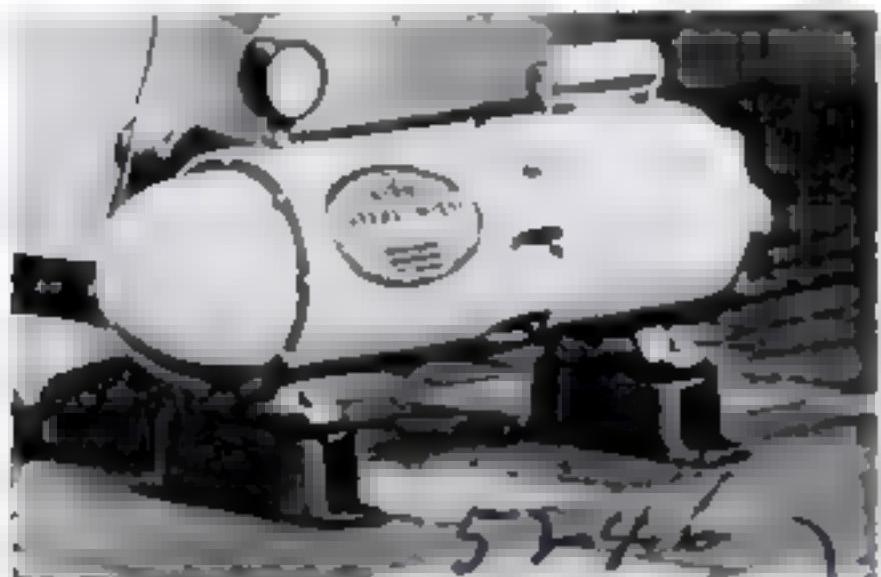


5748

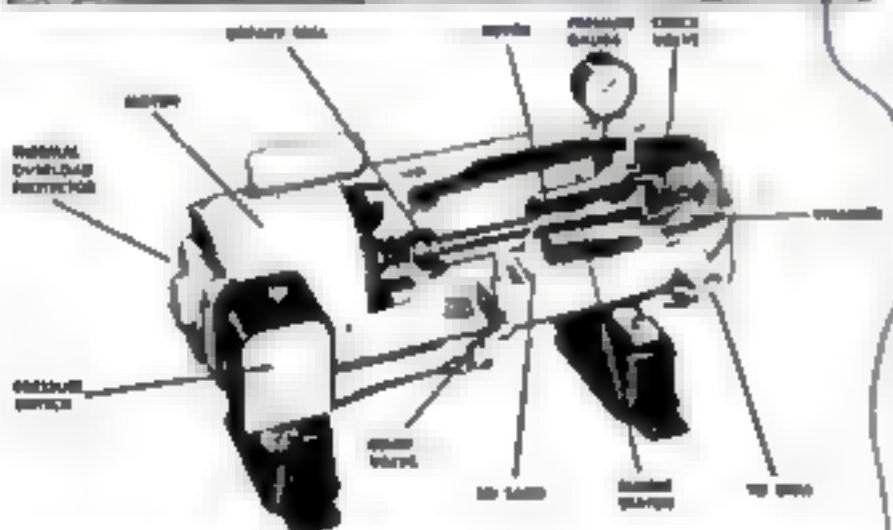
Top Becomes Turntable. This matched plastic pair—a portable electric record player and a carrying case for 25 10" records—is made by the Anfinsen Plastic Molding Co., of Aurora, Ill. The top of the



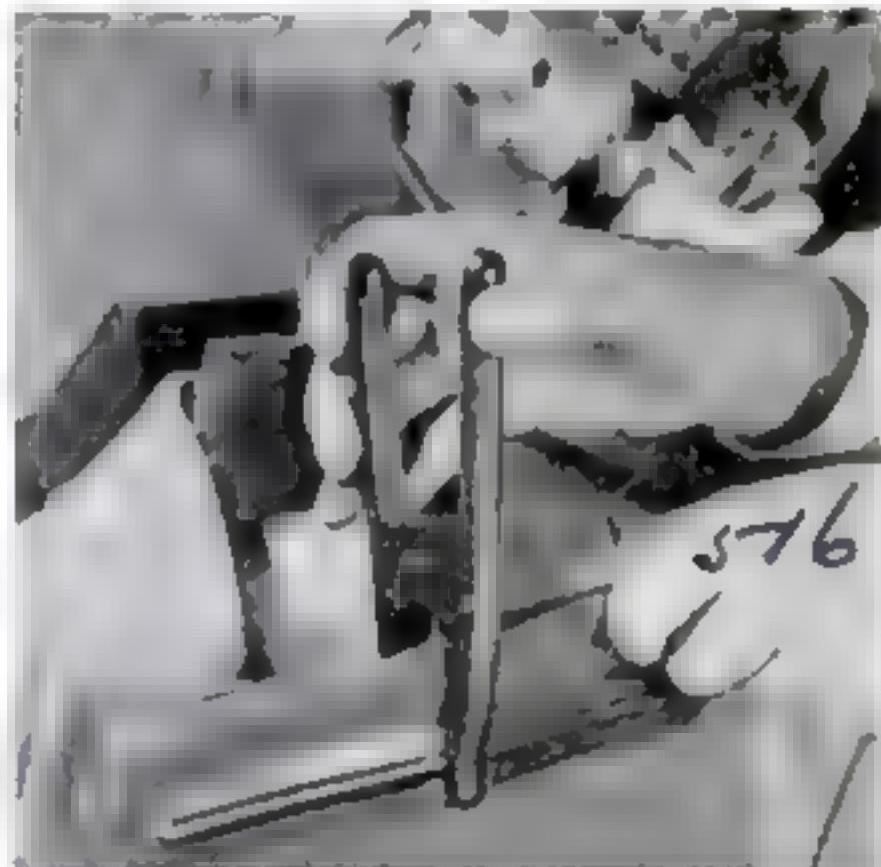
7-lb. player is the turntable when inverted. Ten records may be stored in the bottom of the player. Both pieces are available in several colors and both are provided with elastic carrying straps.



5749



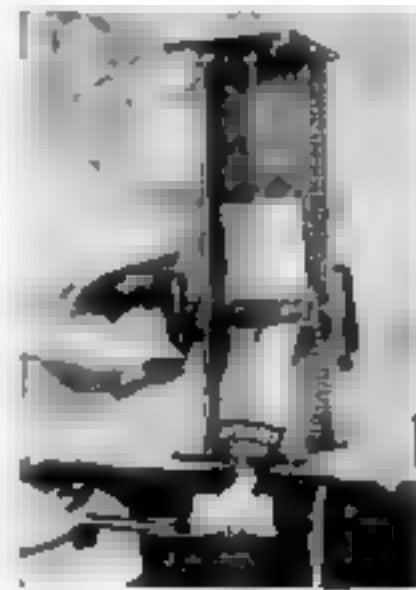
Pumps Water Noiselessly. There are no gears or cranks to clatter in this shallow-well pump. The one moving part turns in a cushion of rubber, insuring virtually silent operation. A $\frac{1}{4}$ -h.p. motor protected by a thermostatic device runs the pump by a direct shaft connection. It is lubricated by the water that courses through it. Two models are available, rated at 250 and 400 gal. an hour. Weighing only 45 lb., the pump may quickly be attached to a tank. One of the advantages of this type of pump is that it starts pumping without being primed. The manufacturer is Robbins and Myers, Inc., of Springfield, Ohio.



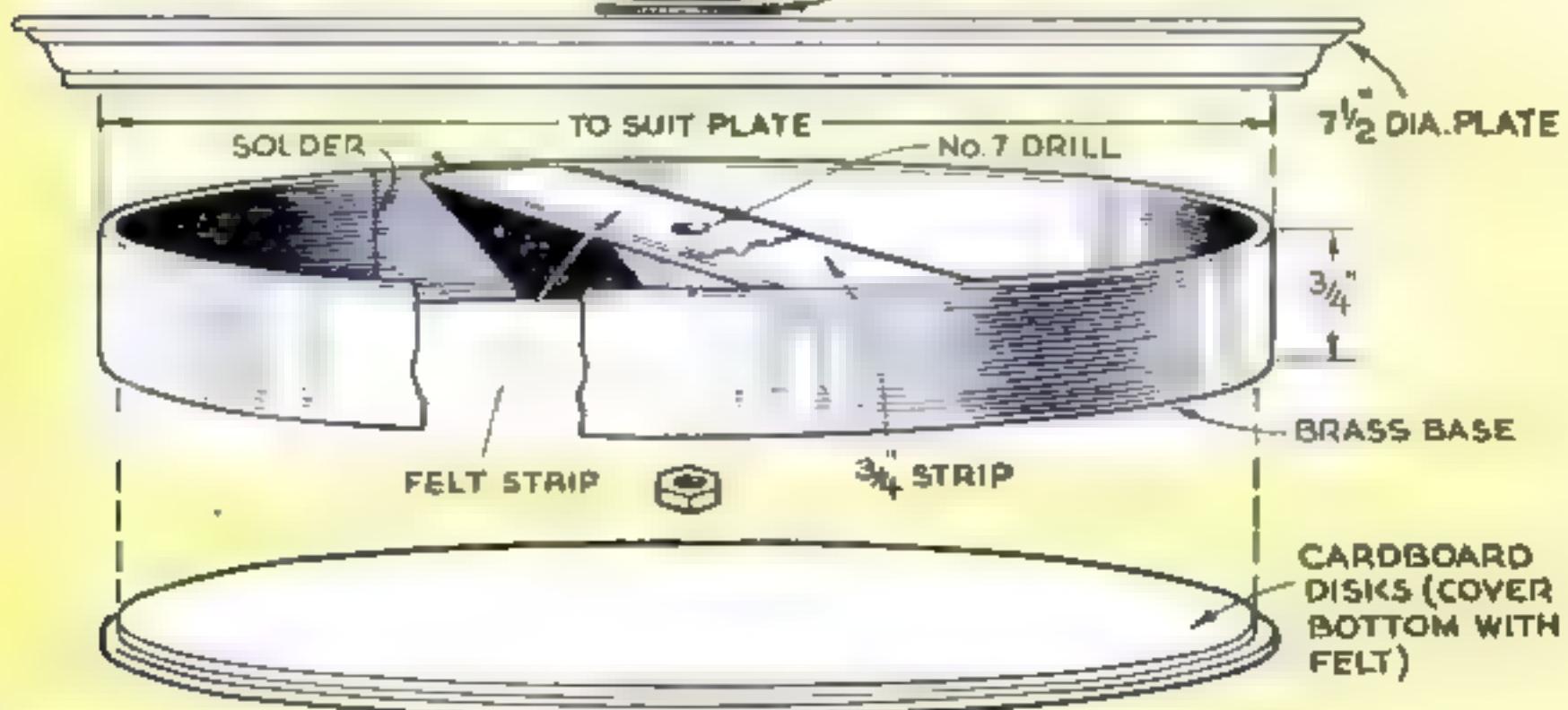
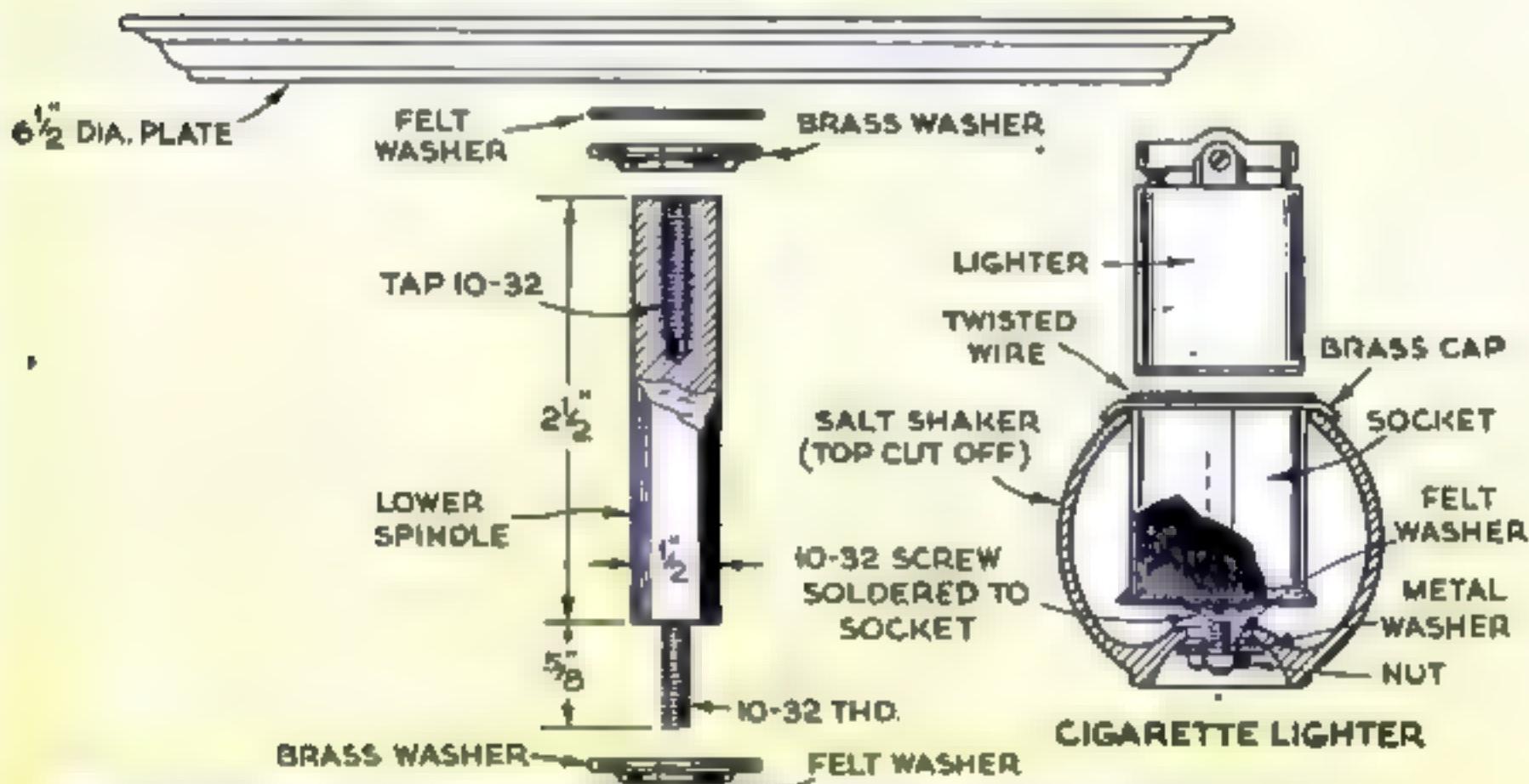
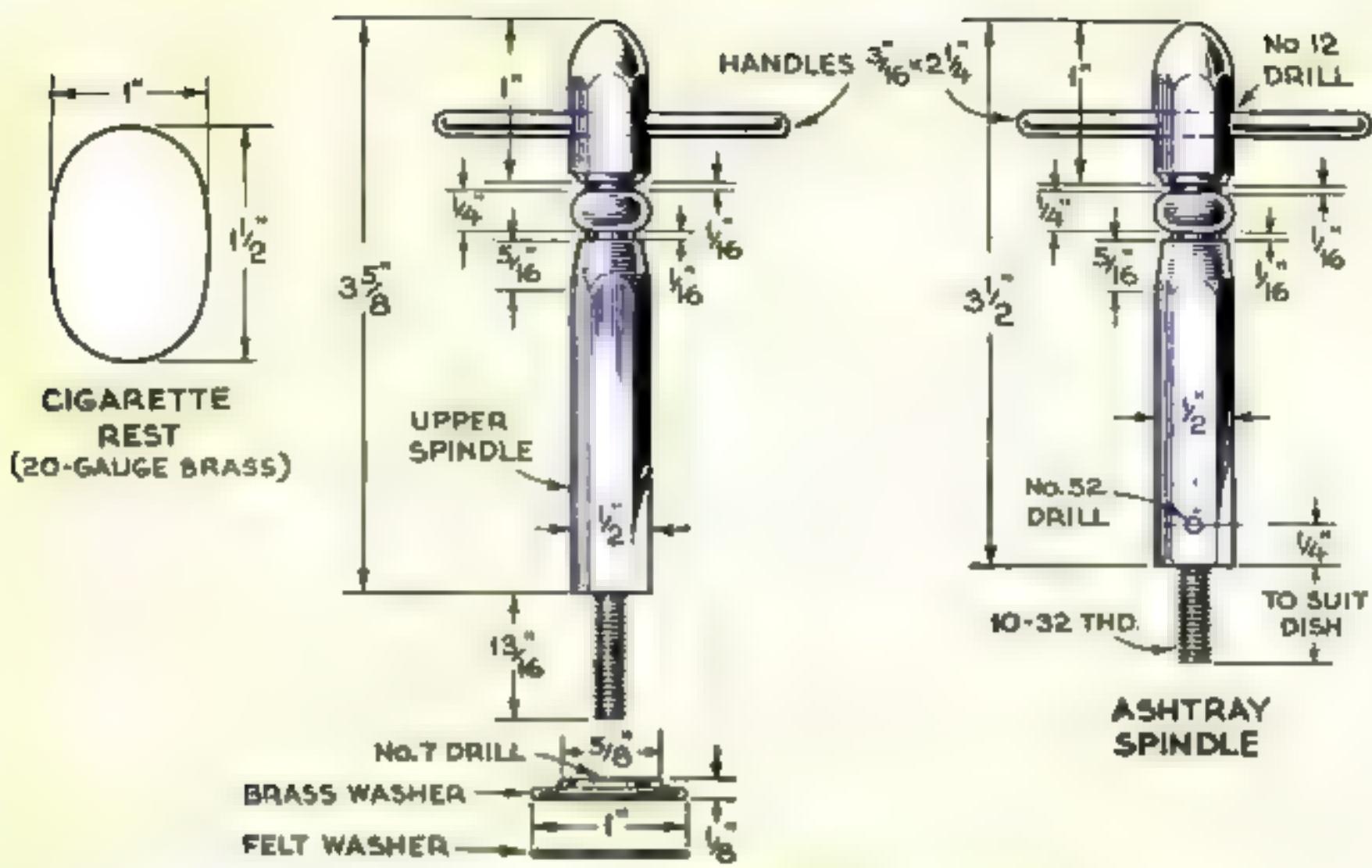
5761

Hanger Clamps Clothes. The hook of this all-metal hanger is an extension of the spring that holds the clamps together. The maker, the Perfect Products Co., of Beloit, Wis., claims the hanger will hold tightly, regardless of a garment's thickness.

Toothpaste Dispenser. An all-plastic toothpaste or shaving-cream dispenser, made by the Amogene Specialty Co., of Long Beach Calif., is said to save about five cents on each tube by squeezing all of the paste or cream from the tube.



5762



New Gifts from Old China

By Bill Luther 4136

AN ASHTRAY, table lighter, and double-decked candy dish make up this different and attractive cocktail threesome. To construct them you'll need a lathe, a hand grinder, and some old chinaware. I used two plates of different diameters, a sauce dish, and a saltcellar.

First step is to locate and mark the centers of the dishes on both sides. Grind holes at these points with a small pointed stone in a hand grinder. Hold the tool at a flat angle, as the tip does little cutting. Grind a little more than half-way through, reverse the plate, and finish from the other side. Moisten the work frequently. Holes through the plates can also be made with a vibrator-type engraving tool, or by the slower brass tube and abrasive method.

The grinder, however, is the preferred tool for altering the salt shaker into a base for the table lighter. Different shakers will present different problems, but the method illustrated can be adapted to most pieces. A thin abrasive disk is used to cut off the top of the shaker, and the wall is thinned down with a small grinding wheel.

Spindles for the ashtray and candy dish are turned from $\frac{3}{16}$ " hexagonal brass rod; the one for the double-decker is made in two sections and screwed together. Shanks on the spindle sections are reduced to $3/16$ " and threaded 10-32.

Cigarette rests are cut from 1" squares of sheet brass. For the curved supporting arms, $1/16$ " brazing rod is used.

Both ends of the rod are flattened so that the cigarette rests can be held on with solder, and the rod is sweated in the spindle hole.

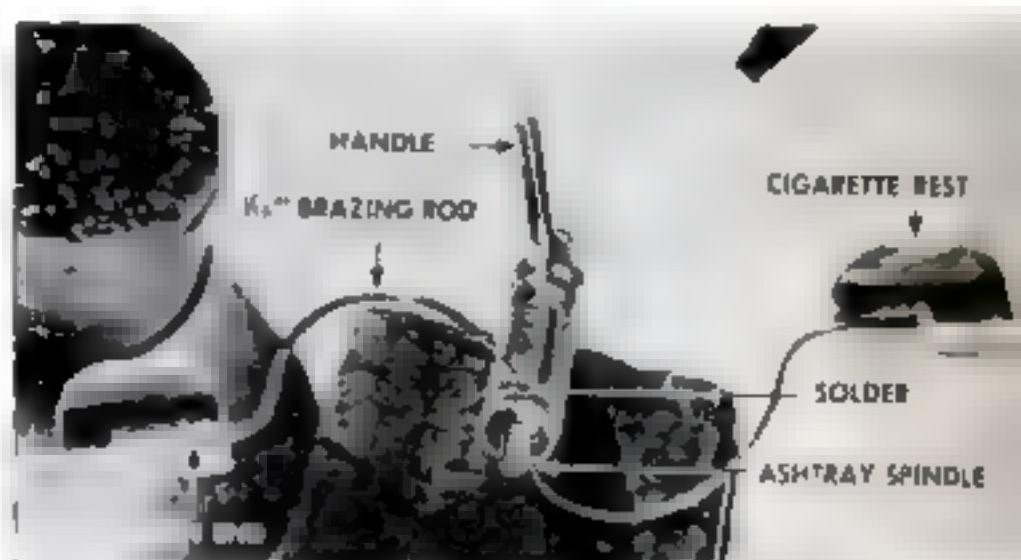
For the base of the candy dish a hoop was formed from a $\frac{3}{16}$ " strip of $1/16$ " brass. Except for the bottom of the ashtray—where space didn't permit—a felt washer was used between each of the brass washers and the meeting face of the plates. The felt is ce-



Three old dishes, a salt shaker, and some brass are the materials for this cocktail-table set



A hand grinder is used both for drilling and cutting. Moisten the glazed china frequently.



Assembly of the ashtray spindle and cigarette rests can be clearly seen in this photograph.



A brass disk is used as a cap for the table lighter. Anneal the metal, then shape a flange with a ball-peen hammer. Bind the socket,

cemented directly to the brass. Cellulose cement is a suitable adhesive.

The top of the cigarette lighter is fashioned from a disk of 20-gauge brass about $\frac{1}{8}$ " larger than the opening in the top of the salt shaker. In this case the diameter of the shaker top was $1\frac{1}{8}$ ", so the disk was cut $1\frac{1}{8}$ ". Anneal the metal by heating it red hot and letting it cool. Scribe the inner circle ($1\frac{1}{8}$ " in this case), hold the metal at an angle on a wood block, and hammer the outer edge with a ball-peen hammer. Anneal the metal again, place on a planishing stake or other smooth, rounded piece of metal, and hammer out the dents.

Smooth the edge by drawing it carefully along a flat file held on the bench. Most remaining hammer marks can be removed by filing, and low spots can be brought up by tapping from the underside. When the piece is smooth, buff with tripoli, followed with jeweler's rouge. Drill a hole through the center, insert a jeweler's saw blade, and

cap, and a flathead screw together and solder them into a single unit. Note that the lighter can be easily slipped in or out of the socket.

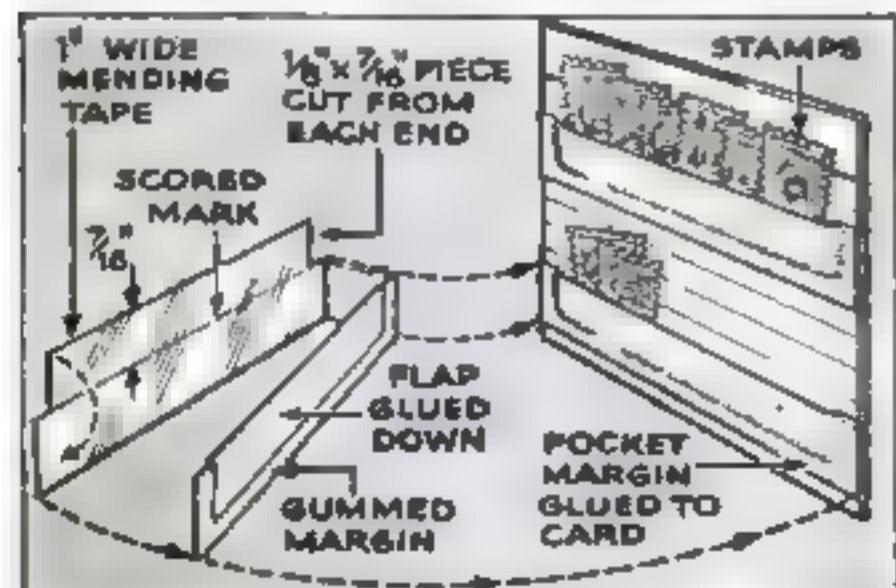
cut out a slot for the lighter. Two strands of tightly twisted brass wire are formed into an oval and soldered neatly around the slot.

Wrap 20-gauge brass sheet around the lighter to form the socket, bind the shaped piece with wire, and solder the lap joint. A bottom piece of the same stock is soldered in. The socket is then soldered to the brass cap.

Polish the brass, wipe all parts with a cloth saturated with lacquer thinner, and coat with clear lacquer. Assemble the pieces as shown, taking care not to draw up too tightly on the threaded shanks. To finish the base of the tiered candy dish, cut two cardboard disks. One fits inside the base hoop; the other is the same diameter as the base. The cardboard pieces are cemented together and to the hoop, and the bottom is covered with felt.

The original cigarette lighter is not altered in any way. It is readily removed from the base for refilling or for pocket use. END

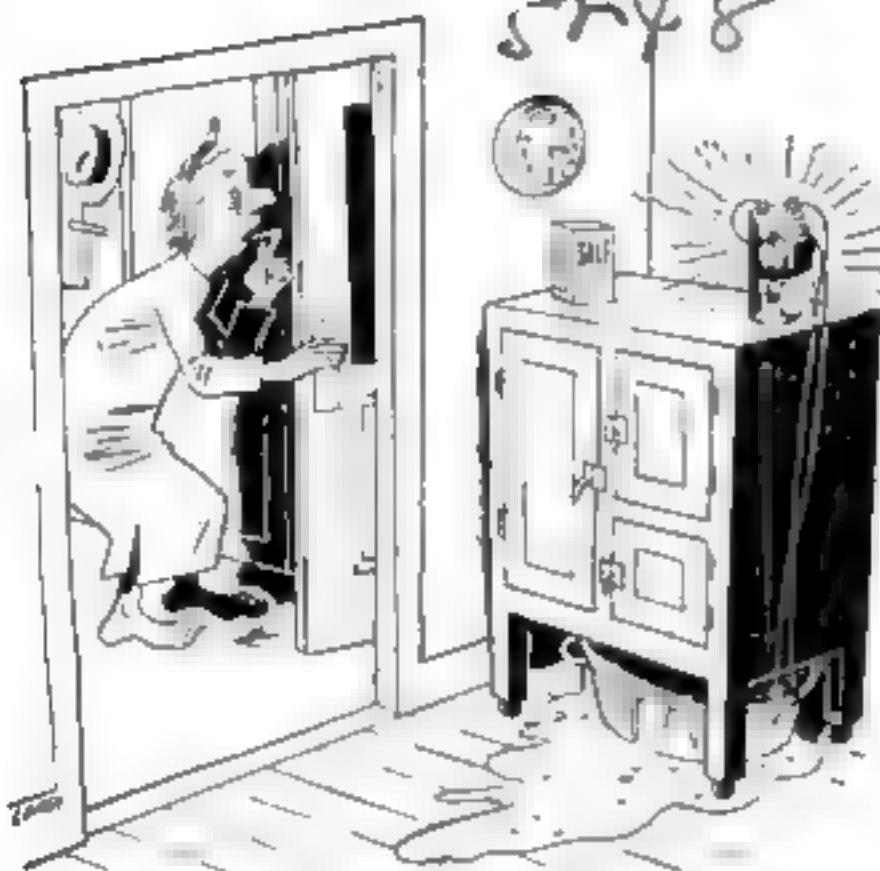
Stamp-Card Pockets Formed from Mending Tape



Stock cards used by stamp collectors can be made up from file cards and 1" transparent mending tape. Cellulose tapes that stick without wetting are harder to use.

For each pocket, cut a strip of tape the width of the card. Score it with a pin or knife point as shown and fold along the scored line. Snip out a $\frac{1}{8}$ " by $7\frac{1}{16}$ " oblong from each end, moisten the upper flap, and stick it down along the lower one. The gummed margin can then be moistened and applied.—Pat Fey, Manhattan, N. Y.

What's Your Ingenuity Quotient?

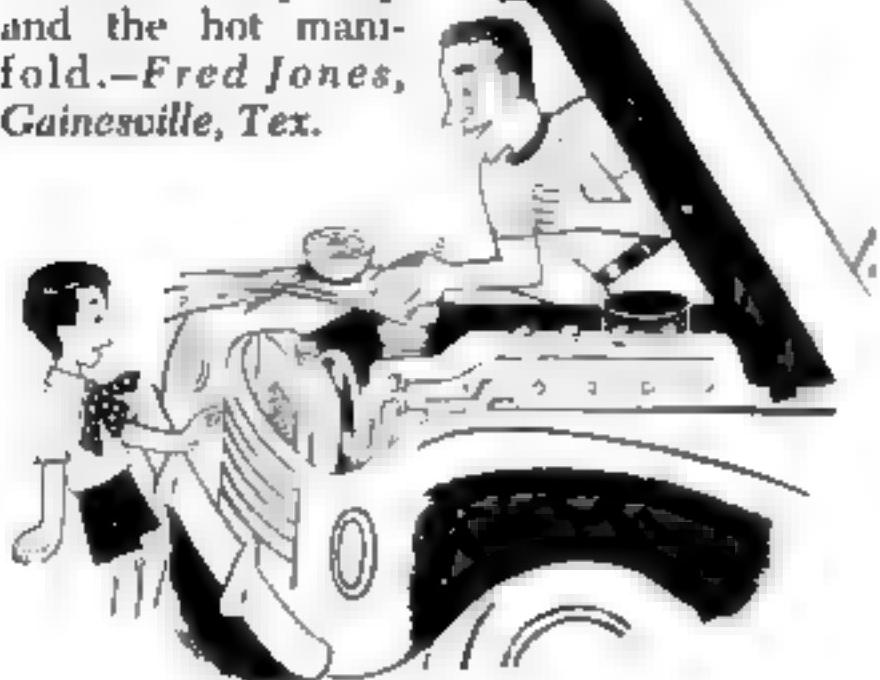


5748

At last I know when to empty the ice-box pan. I rigged a doorbell and a dry cell and placed the ends of the wires just below the rim of the pan. When the water reaches the wires, the bell rings. A dollop of salt in the water helps conductivity.—*Leslie Graves, Livingston Manor, N. Y.*

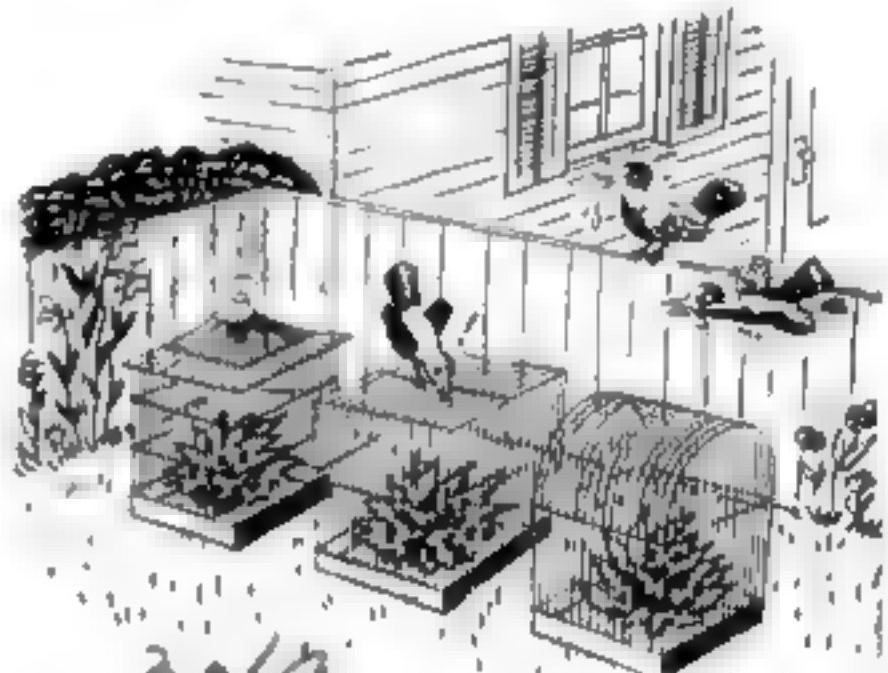
My job calls for about 1,000 miles of driving every week. That was okay until I began having a lot of trouble with vapor lock. I stopped that by squeezing a half grapefruit over the fuel pump. The fruit dried to form an insulating wall between the pump and the hot manifold.—*Fred Jones, Gainesville, Tex.*

2393



156

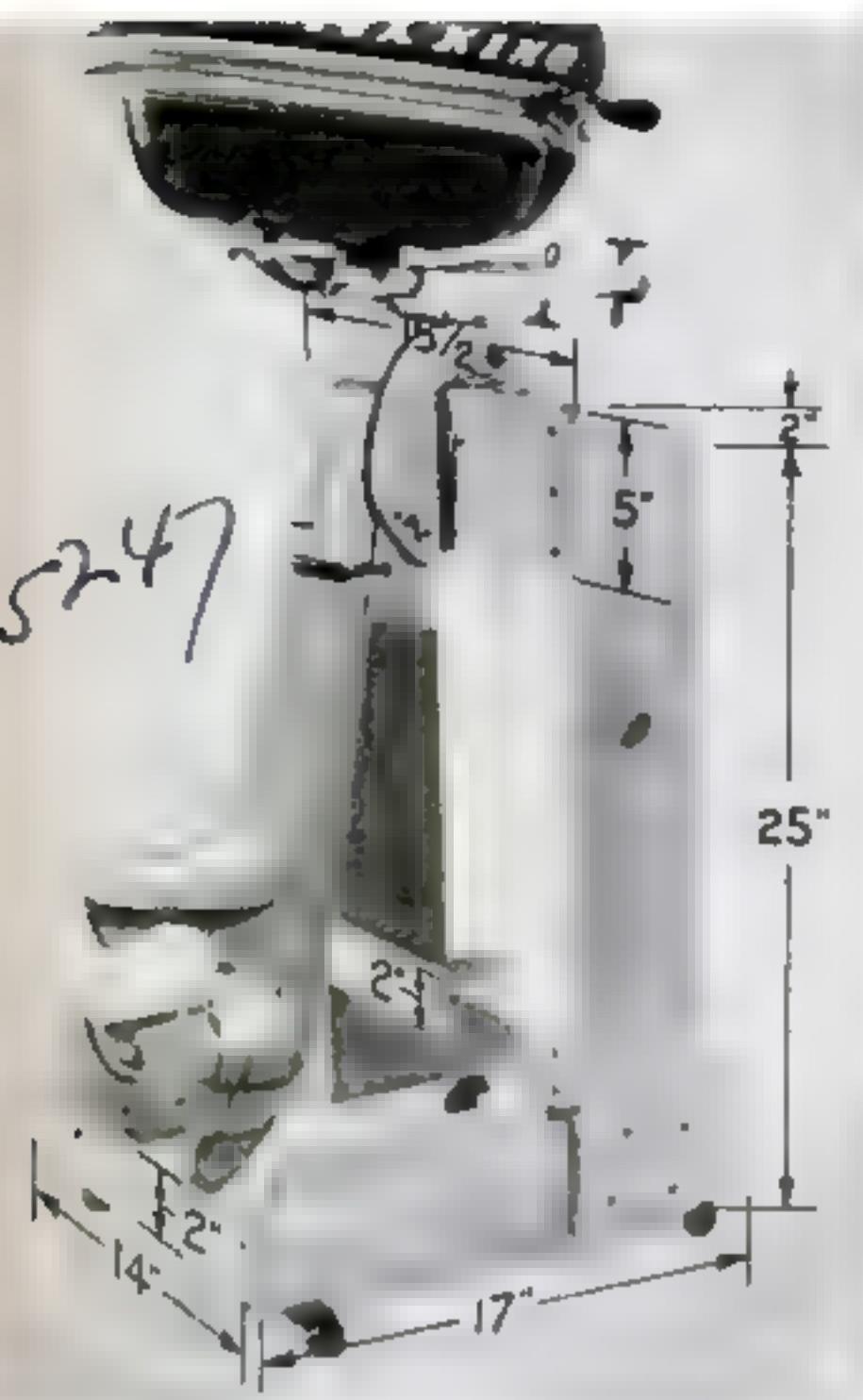
We moved into a house that must have been occupied previously by hungry wood-peckers—the walls were full of holes. When I painted the walls, I kept a roll of tissue handy. Whenever I came to a hole, I sopped a wad of tissue in the paint, packed it in, and painted right over it. No holes now.—*Margaret E. Casson, Reseda, Calif.*



3069

My strawberry plants were being used as a free lunch counter. Every time I glanced out the window I saw a gang of birds chomping on the berries. However, I broke up that act by removing the bottoms of old bird cages. They're fine plant guards.—*Roger M. Johnston, Glendale, Calif.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.



Outboard Stand Built of Pine

When an outboard motor is not in use, it is best to store it in an upright position. A stand on casters is ideal for this. The motor is held securely yet it is accessible from all angles for cleaning, lubricating, or overhaul work.

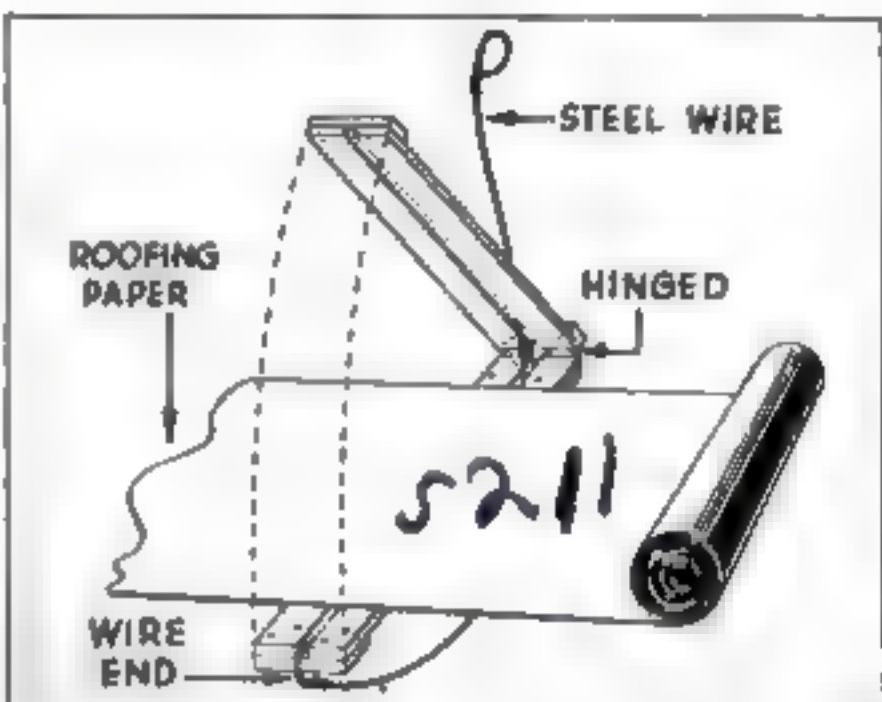
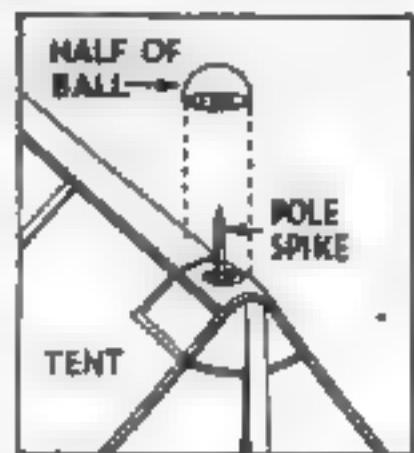
Random widths of $\frac{3}{4}$ " pine were used to build the stand pictured above. The upright frame is positioned so that the weight of the motor is centered over the base. No. 8 wood screws $1\frac{1}{2}$ " long were used throughout. Waterproof glue also was used.

The only critical dimension is that from the top of the stand to the floor. Before you fasten the parts together, make certain that the finned propeller guard will clear the floor. Good-sized casters will increase your clearance and make for easy rolling.

With an attractive natural finish, the motor and stand will decorate a recreation room or den between seasons. Sand all surfaces smooth, apply a coat of shellac thinned with alcohol, and sand lightly with very fine paper. Apply one or two coats of varnish.—*Jed Robbins, Manhattan, N.Y.*

2/2 Rubber Ball Stops Tent Leaks

A SPONGE-RUBBER ball cut in half will solve the problem of a leak at the pole spike of a tent. Force a half of the ball over each spike, as shown in the sketch, so it will rest lightly against the canvas. Even if the spike projects through the ball, the soft rubber makes a seal around it. The balls may be left in place when poles are stored.



Roofing Paper Cut with Wire

This cutter for roofing and building paper is made of four 40" pieces of crating material. Space each pair of slats about $\frac{1}{2}$ " apart with a cleat at each end. Hinge one end as illustrated. Attach a steel wire at the other end. To cut, place the paper as shown, close the frame, and pull the wire.—*Victor H. Lamoy, Upper Jay, N.Y.*

Lipstick Tube Holds Eraser

A DISCARDED lipstick tube makes a dust-tight holder for a draftsman's eraser. First clean any remaining lipstick from the holder. Then select a good-quality eraser and, with a razor blade, whittle it to a size that will fit snugly in the retractable section of the tube. Such an eraser holder will keep the rubber clean, even if it's carried in your pocket.—*Don G. Pitticood, Moscow, Id.*





Ernest Warther puts finishing touches on a model of a Civil War engine carved of ivory.

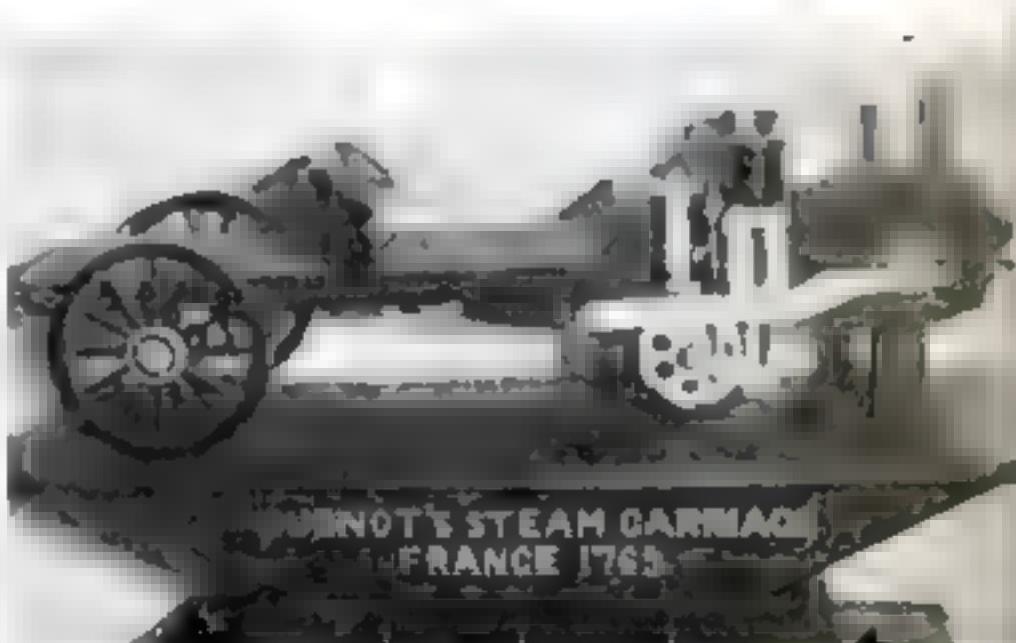
Famous Locomotives 524/ Carved in Wood and Ivory

A HALF century ago neighbors referred to Ernest Warther as "that boy who whittles."

Today, at 63, Mr. Warther still is whittling. Carving scale models of locomotives is a full-time business with him now. His models, tracing the evolution of transportation on rails, reflect the skill and patience of a master craftsman.

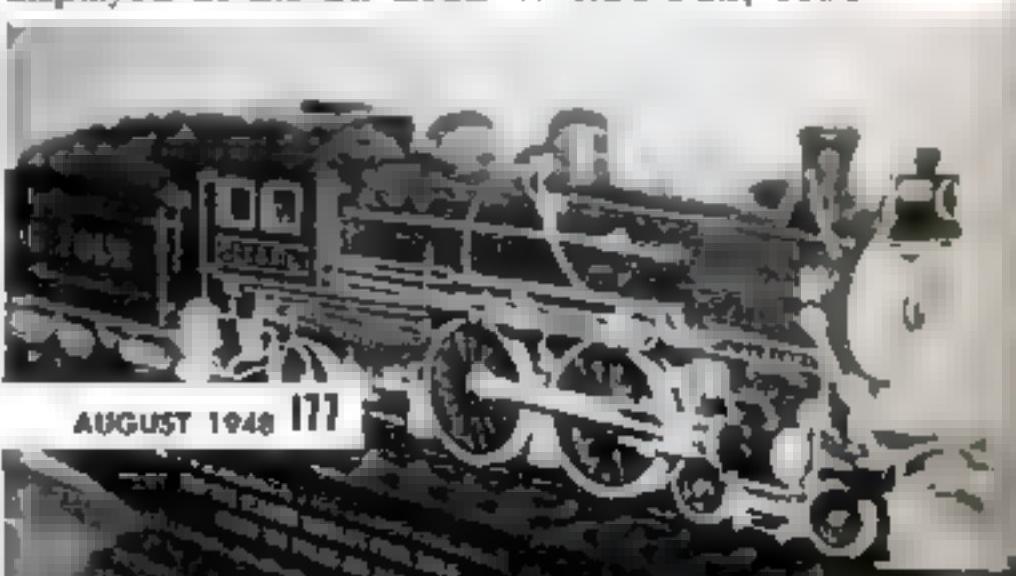
In a workshop behind his Dover, Ohio, home he now is shaping his latest model—a locomotive carved entirely from ivory. The city of Dover has plans for a museum to house Mr. Warther's carvings. Besides locomotives, he has modeled ships and animals.

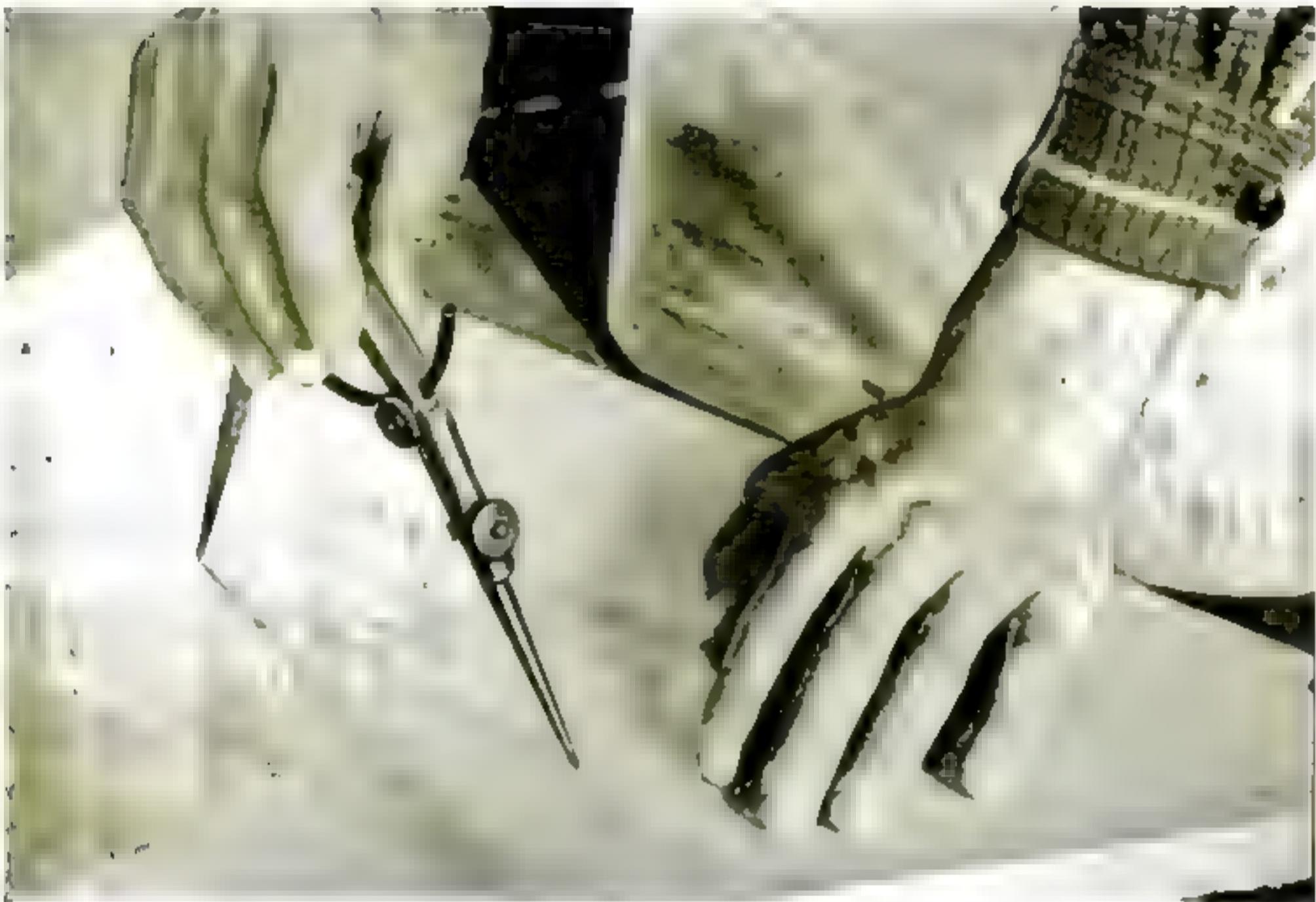
The first successful locomotive, the Rocket (1829), developed only 50 lb. boiler pressure.



This wheeled nightmare, its boiler in a bustle, ran on roads instead of rails way back in 1765.

A model of the Atlantic-type 4-4-2 locomotive displayed at the St. Louis World's Fair, 1904





Working in the Round with Hand Tools 337⁵

Care is the principal ingredient of well-cut circles and holes, but these tips on technique may also help.

By Edwin M. Lore

FLAT surfaces and square edges are the bedrock of woodworking craftsmanship. But like the human skeleton or the framework of a building, they frequently gain in beauty by being concealed or covered. Previous articles in this series discussed the uses of bevels, chamfers, and recesses in relieving the monotony of squared edges. The same function is performed on larger pieces by the careful use of curves. In addition to lending grace to a project, curves and circles also have definite functional importance. Even a toy wagon would run poorly on square wheels.

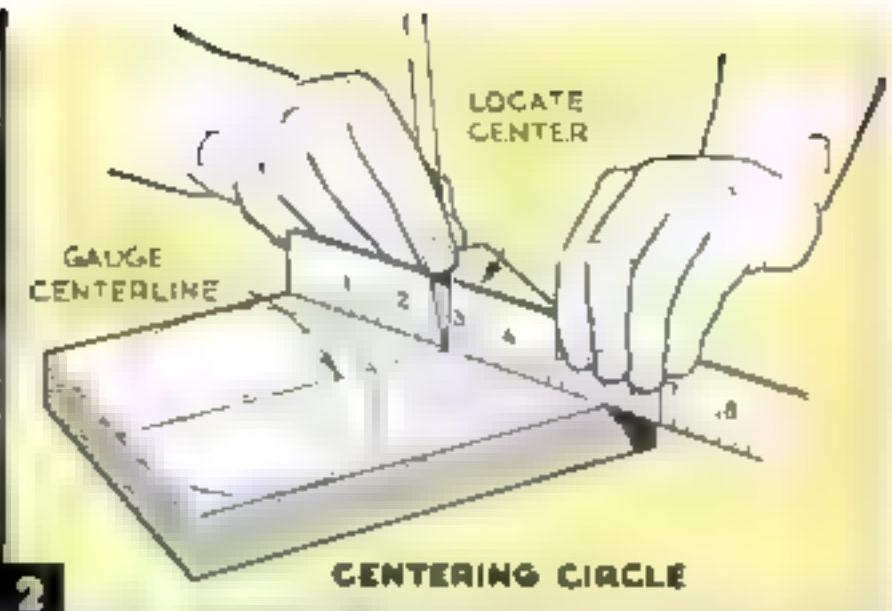
Because circles are laid out with a compass, they are the easiest curves to draw and cut. Guide lines may be made with either a pencil compass or with dividers. The latter give greater accuracy because they scribe a fine line of uniform thickness.

Either instrument should be capable of remaining at its preset position without slipping; dividers especially may be thrown off their proper curve unless they are locked after being set. To set a pair of the kind illustrated above, loosen the locking screw and spread the points to the approximate span. A slow-motion screw at the end of the quadrant (Fig. 1) brings the setting to perfect accuracy.

A board from which a circle is to be cut is usually brought to thickness, but the back need not be smoothed because further planing may be required to remove splinters



1



2



3



kicked up by the saw. Press one point into the wood and pivot around it with the other to scribe a sharp line.

Marking the Centerline

Whenever a circle must be accurately placed on the work, its center has to be located carefully. In Fig. 2 it is tangent to both edges and one end. Tangent circles crop up frequently for several reasons. Tangency is necessary in cutting the largest possible disk from any given board or when an end is to be cut into a semicircle.

A standard method for gauging a center line is shown in Fig. 2. It consists simply of resting a rule obliquely across the face of a board at whatever angle gives an equal number of divisions. To avoid marring the work with a center prick, lay a piece of thin plastic or an old negative over the wood to pivot the divider.

Dividers are handy for stepping off uniform lengths on a board. Set the span, imprint the points on the piece, swing a leg around 180 deg., and mark that point. Continue to the end. If equal divisions are wanted regardless of length, estimate the span, and step off the work experimentally.

Correct the span on each test until the right one is found.

A semicircle having a finished straight edge is scribed (as in Fig. 3) by holding a block against the edge to provide footing for the pivot point of the dividers.

Sawing a Circle

Circles can be cut with a number of different tools. A compass or keyhole saw may be used as in recessing an edge. Clamp the board upright in a bench vise, and shift its position as necessary. Remember that since the cut is rough a little material should be left outside the line for smoothing.

A coping saw with a wide blade is satisfactory even in rather thick wood. Thin and small work is best supported on a board notched with a deep V-cut (Fig. 4 inset) and clamped to the bench. Set the blade in the frame with the teeth pointing downward to draw the work against the support (Fig. 4). Turn the piece as required. A smoother cut can be made by inclining the saw forward than by holding it upright, but the slope must be regulated to fit the sharpness of the curve.

The small size of a block plane makes it



5

a handy tool to use in smoothing outside curves, as in Fig. 5. Sliding the fingers of the left hand against the wood while the plane rocks over the curve helps to keep the edge square with the face.

A curve that is left rough by unskillful sawing benefits by trimming with a chisel, as in Fig. 6. Downward pressure on the handle, coupled with a sidelong swing of the edge, quickly removes ridges and tears in the grain.

Smoothing the Edge

The use of a spokeshave is illustrated in Fig. 7. It is a double-handled frame that has a keen blade clamped in the opening. Though it operates like a plane, the short sole of this tool enables it to slide freely over an outside or an inside curve. It may be pushed or pulled. On wide lumber (1" or more) give it a shearing sidewise motion while stroking it forward. Blade projection is set by sighting across the sole, or by resting the frame on a board, inserting the blade,

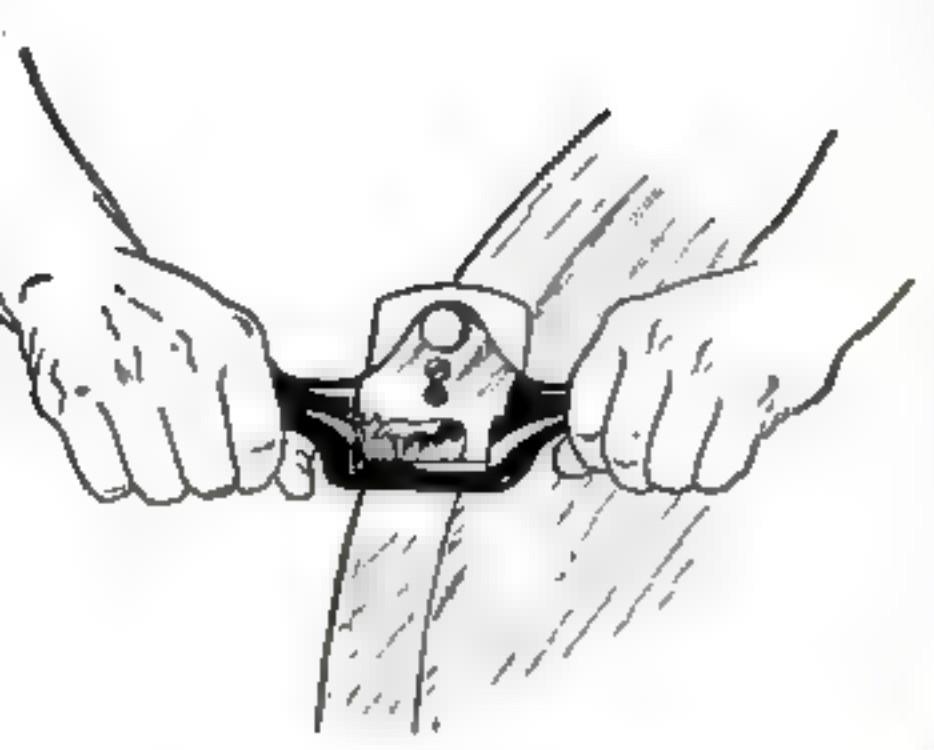
and pressing down while tightening the setscrew. The latter setting gives a thin shaving suitable for final smoothing.

Inside Circles

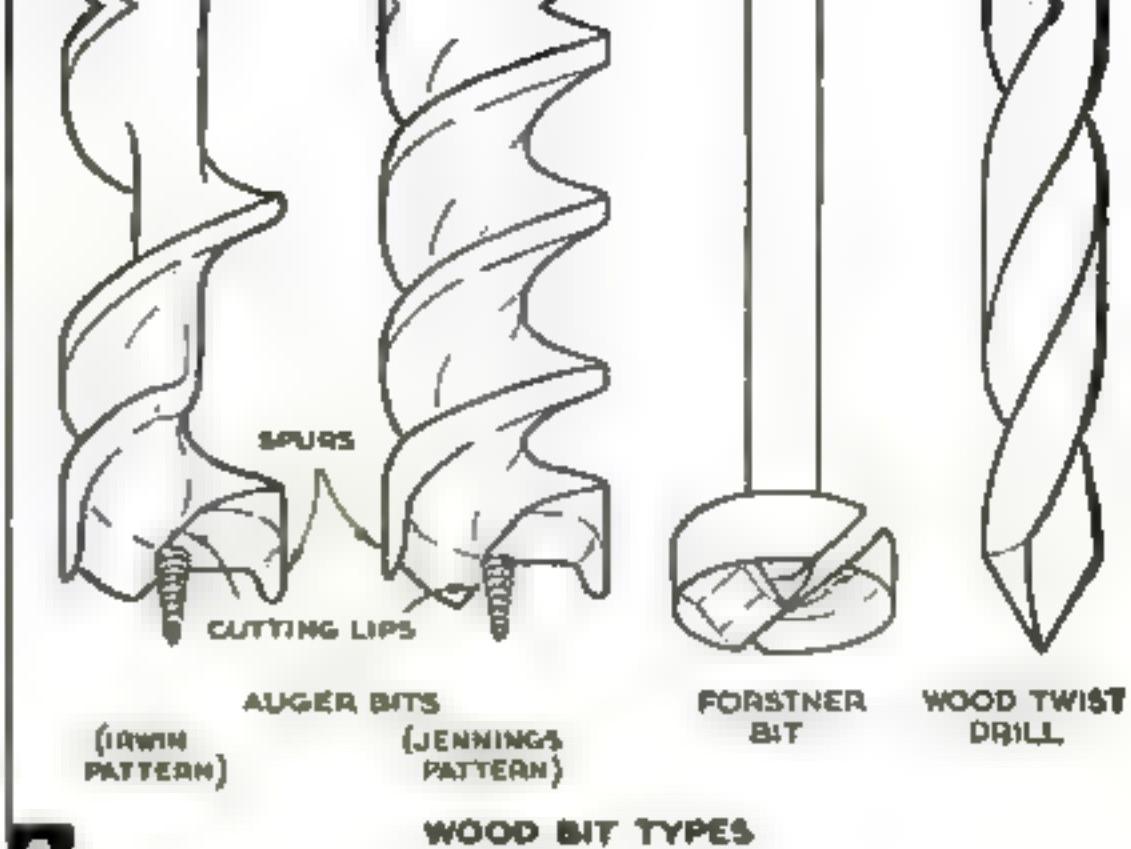
Inside circles are made in the same way as outside circles. Leave some waste wood to allow for smoothing. A cabinet file is often the best tool for smoothing inside curves.

Enclosed circles cannot be cut without boring holes to receive a blade. Auger bits (Fig. 8) are most used for this purpose. The traditional type has two cutting lips, two spurs for trimming the outside of the hole, and a threaded, tapered point. Chips are lifted with a single or double worm. A square end on the shank gives the brace a positive grip. The Forstner bit substitutes an edged rim for the spur. Because the rim is supported by the groove it makes, this bit will cut an arc from the edge of a board or bore without deflection through wood having hard spots, such as knots. The twist drill is useful for boring where nails might be





7 USING SPOKESHAVE



8 WOOD BIT TYPES

encountered, but is available only in small sizes graduated in $1/32$ " steps.

As large bits are costly, holes above $1\frac{1}{8}$ " in diameter are usually bored with an expansive bit, illustrated in Fig. 9. It is especially useful for boring odd-sized holes, since the wing cutter can be set at any desired friction. If the diameter of the hole must be accurate, try the setting on scrap and measure the test cut. Sets of bits having interchangeable cutters are now on the market. One such is shown in Fig. 10

Braces are made in a variety of styles and sweeps. A good size has a 10" sweep or circle of hand movement. Many models can be set for ratcheting

Boring a Hole

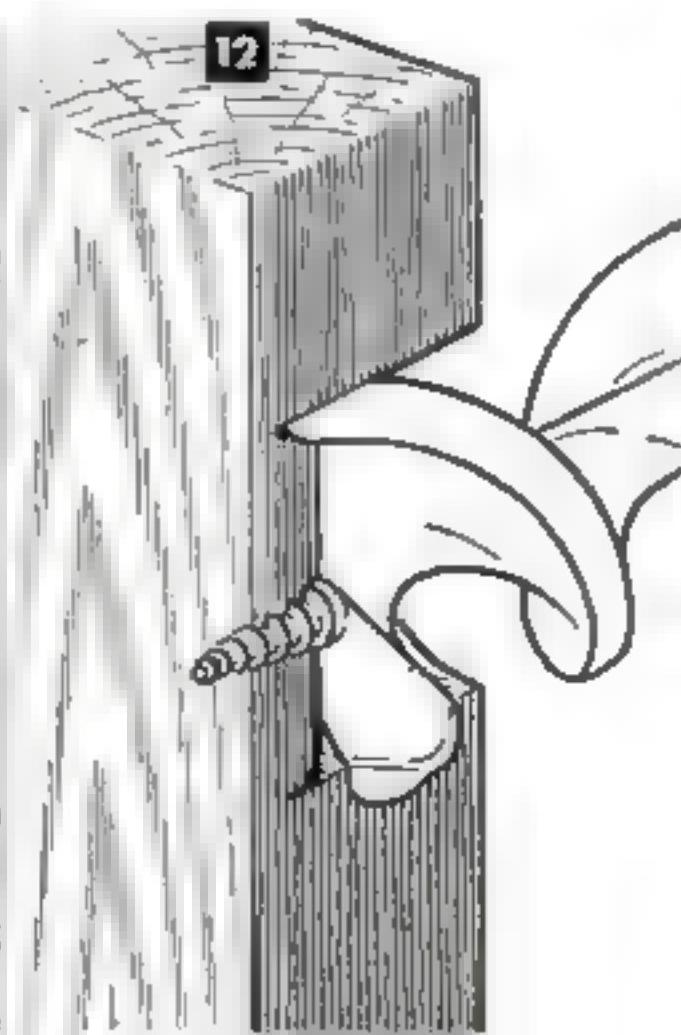
Center a bore by stabbing the screw point lightly into the board at the mark. If it slips off a hard grain into soft wood beside it (as may happen in fir) or if the wood is so hard that the point will not readily enter, punch a starting hole with an awl. Use a punch to

start also if the threaded tip is old or worn. Rest the work on blocks to protect the bench top (Fig. 11), hold the bit upright, and turn the brace. Heavy pressure is not ordinarily needed on the top of the brace, since the threaded bit point feeds the cutting edges into the wood. When the hole is nearly through (Fig. 12) and so much of the point projects that it stops feeding, turn the work over and finish boring from the other side. If too much pressure is applied when the cut is nearly through, the bit may crush through the rest of the way and splinter the underside

Keeping Bits Sharp

Dull bits do not perform any better than dull planes. Purchase a bit file to keep with the kit and use it to restore the keen edges as shown in Fig. 13. File cutting lips from the top and spurs from the inside. If a bit spur has been filed away, or even filed on the outside, the bit is useless and should be discarded.

END

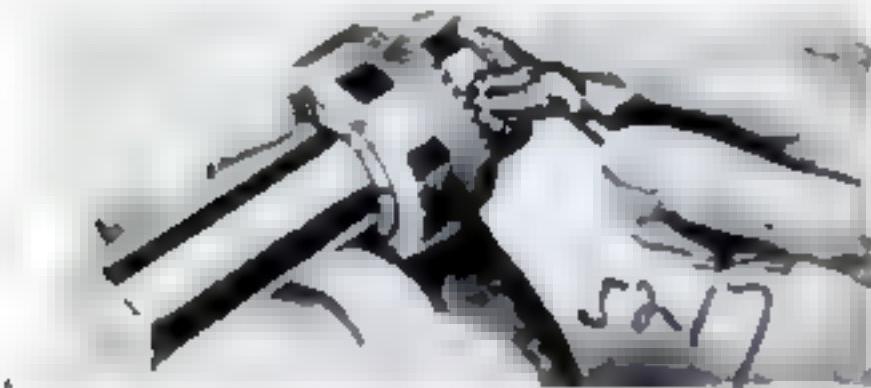




NEW TOOLS



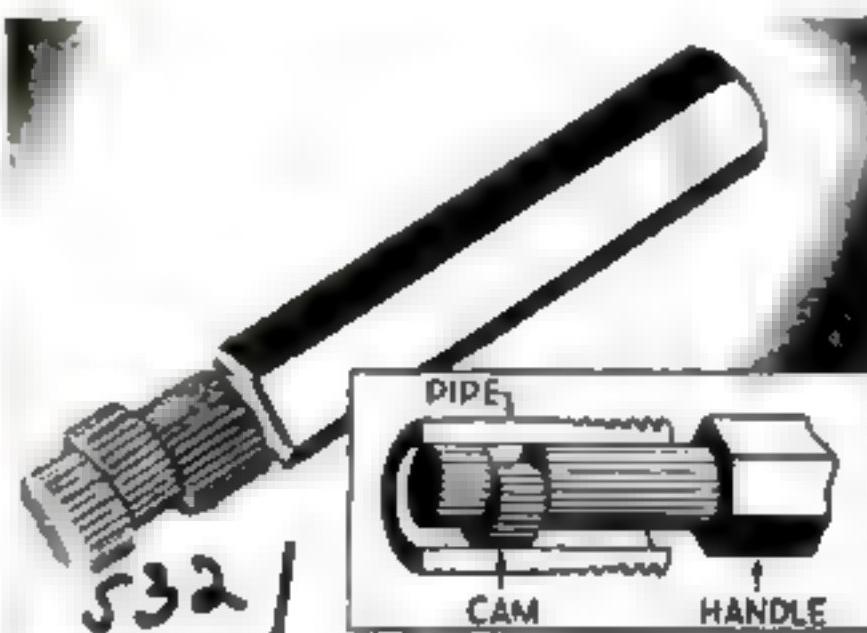
Brazing Kit Has Heat Chamber. Offered by the American Products Corp., Chicago, this compact outfit contains all necessary materials and equipment for light bench brazing. The heat-retaining chamber, pinned together of asbestos board, permits handling fair-sized jobs with a small torch. Also included are an alcohol torch, fuel, flux, and assorted silver solder. It sells for about \$7.50.



Lathe Collet Chuck. Threaded on the spindle nose of a lathe, this new collet chuck grips round stock tightly and accurately. It's supplied with three double-ended collets that take work in six sizes between $\frac{1}{2}$ " and $1\frac{1}{8}$ ", and the chuck itself can be used without a collet to hold 2" stock. Made by Martin Chuck, of Milwaukee, it costs about \$12 in alloy and \$19 in steel.



Micrometer Does Double Duty. With this instrument, developed by the Richards Machine Tool Company, of Glendale, Calif., you may take either inside or outside measurements at will. Any setting of the external calipers automatically is the same on the internal calipers, permitting direct comparison of mating or telescoping parts. The measuring screw is hardened and the thread ground for long life and accuracy. Several different sizes are made.

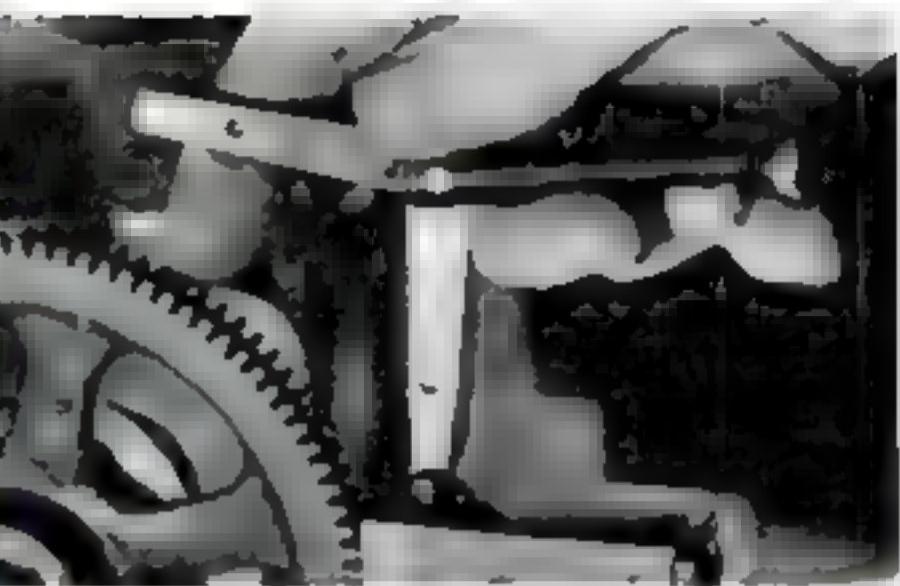


Eccentric Wrench Holds Pipe. When inserted in a pipe or nipple and revolved in either direction, the center serrate section of this wrench swings cam-like to engage the inside of the pipe. It is turned by either an open-end or adjustable wrench. The Kiener Machine Products Co., of Los Angeles, makes the tool to retail for about \$2.

Husky Little Screwdriver Folds to Pocket Size

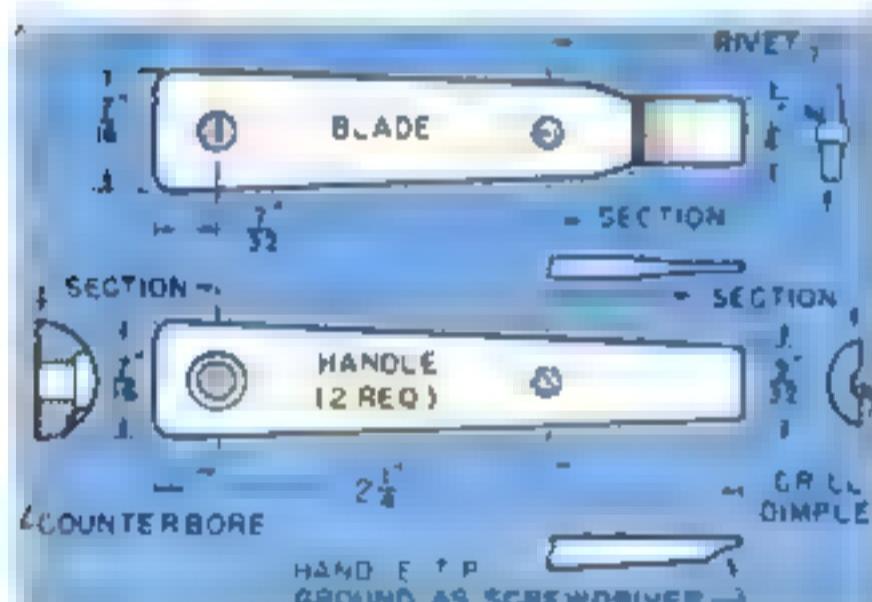
ALTHOUGH only about the size of a pen-knife, this folding screwdriver is rugged enough for really heavy work. The blade is sandwiched between two pieces of tapered steel that may be used as blades themselves.

With a hacksaw, thin abrasive disk, or slitting saw in a milling machine, split lengthwise a 4" piece of $\frac{3}{8}$ " drill rod. File the two cut surfaces if you've used a hacksaw. Soft-solder the two halves together in their original position. Then chuck the assembly, taper $2\frac{1}{8}$ " of it as shown in the drawing, and cut off. Drill and counterbore a hole for a steel rivet that acts as a pivot. Heat the pieces to separate them, wipe off all solder, and round the sharp edges.

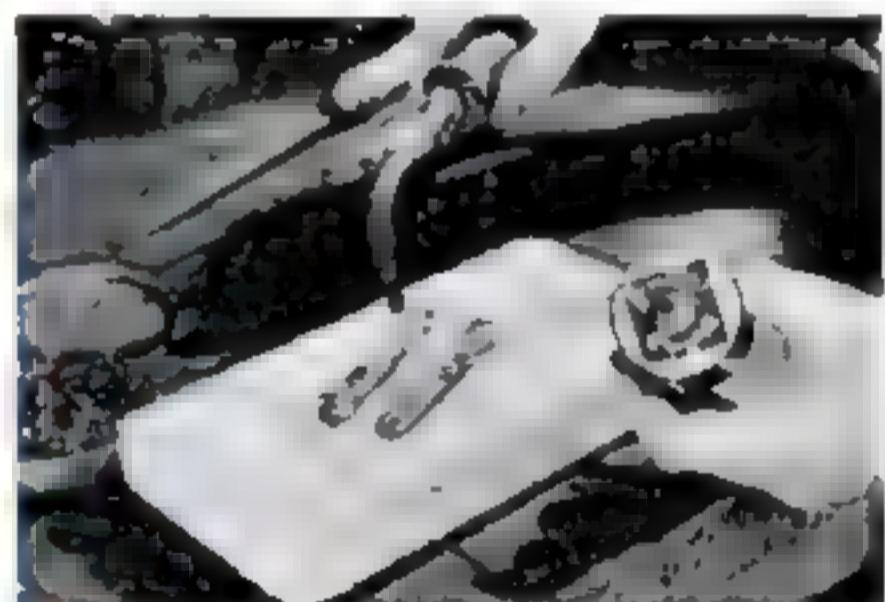


Using a handle piece as a pattern, make the blade of $\frac{3}{16}$ " steel. Grind the blade tip as a screwdriver and drill the pivot hole. Drill a second hole $\frac{1}{16}$ " from the tip, using a $1/16$ " or $3/32$ " bit. Temporarily assemble the parts and use the second hole as a guide for spotting dimples on the inside surface of the handle pieces. Peen over the ends of a steel rivet in the blade hole and file them down until they project no more than $1/64$ ". These projections will fit into the dimples to keep the tool closed.

Harden and temper the handle and blade. With the ends of the handle pieces shaped as blades, you'll have three blade sizes in one tool.—Walter E. Burton, Akron, Ohio.



If you grind the handle tips as blades, round off the corners to prevent wear on your pocket.



Use soft solder to assemble the two halves of the drill rod before turning them for handles.



Cutting off handle assembly. Tailstock, used as outboard support, was moved for photograph.



Here are the four parts of the folding screwdriver. Smooth all edges with abrasive cloth.

309



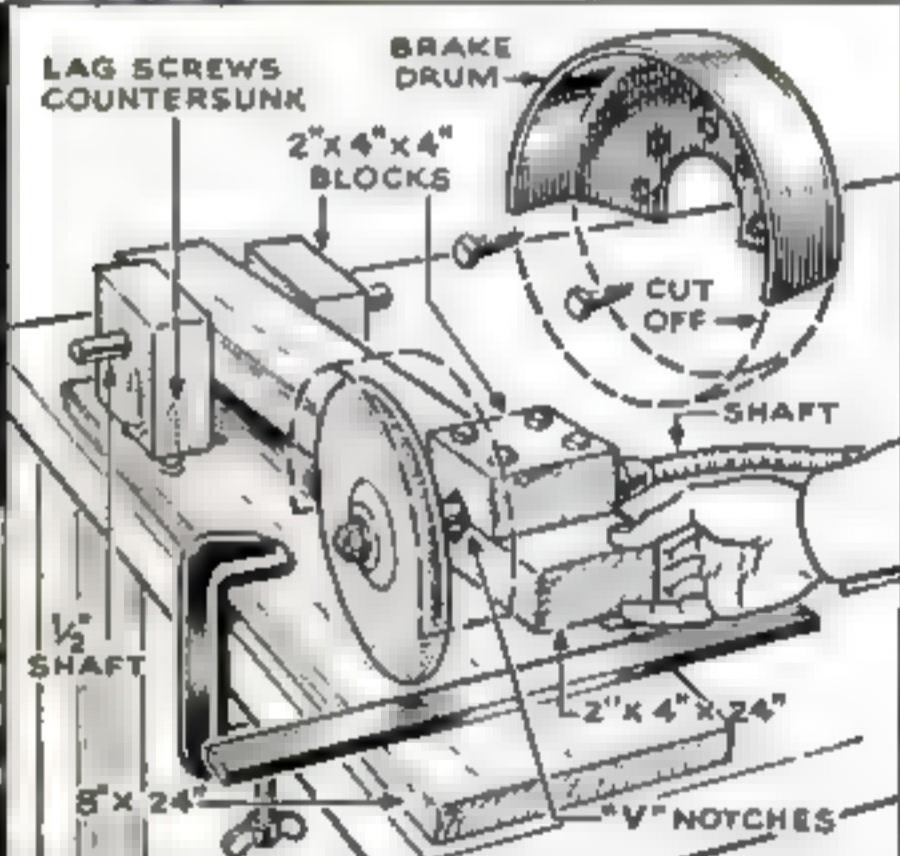
MILL MAKES SCREWS. Modelmakers and others who occasionally have to make up a few special screws will find hollow end mills a great convenience. They are particularly useful in making small screws—4-40, 3-48, 2-56, and the like.

To make a mill, chuck a length of drill rod, face, and centerdrill the end. Run in a hole about 1" deep, using a drill the same diameter as the screws to be made. Cut off and clamp the blank in a vise, face up. Scribe four lines tangent to the hole 90 deg. apart. With a fine file held parallel to the line nearest you, form a single cutting edge or tooth. File three others the same way.

Then chuck the mill in the drill press. While it is rotating, bring it lightly against a flat oilstone. File the slight flats thus formed just to the point of disappearance. Rake is formed by undercutting the teeth with a three-cornered file. For use as a side mill, file edge relief as shown.

Heat the mill to cherry, quench, and temper by gently reheating the shank and requenching at a light straw. Dress the teeth with a fine stone. To use, chuck the mill in the tailstock and feed it against suitable rod revolving in the headstock. At left above are various pieces of shouldered hex rod and finished screws.

5210



Improvised Metal Cutter. The power metal cutter pictured above was made of a flexible shaft, a saw-gumming wheel, and scrap lumber. If the shaft speed is high enough, a flexible abrasive cutoff wheel may be substituted. Follow the speed directions printed on the wheel's label.

To protect my face and body in case the wheel should break, I wore a heavy plastic grinding shield and a thick jacket. A better

precaution is a wheel guard cut from an old brake drum, as shown in the drawing, and screwed to the arm and block holding the shaft.

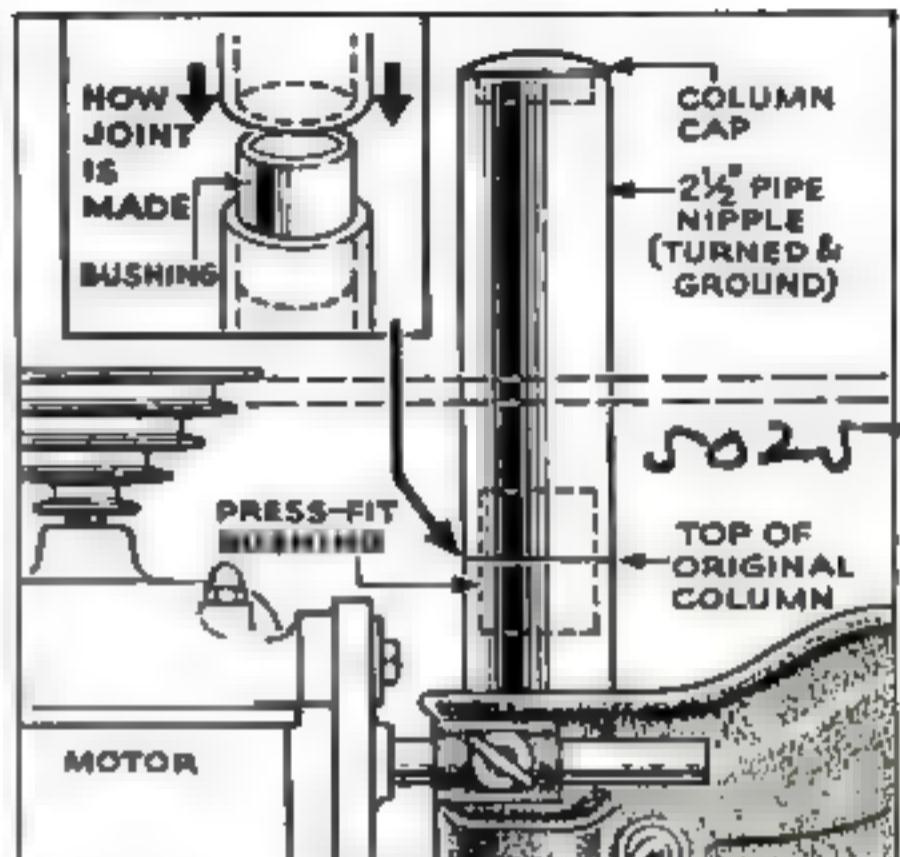
The base of the cutter is a 1" board. The 2" by 4" by 4" blocks act as bearings for the $\frac{1}{2}$ " shaft. The shaft, in turn, acts as a pivot for the 24" movable arm. Work should be clamped or otherwise firmly held under the wheel.—*Don G. Pittwood, Moscow, Id.*

5298



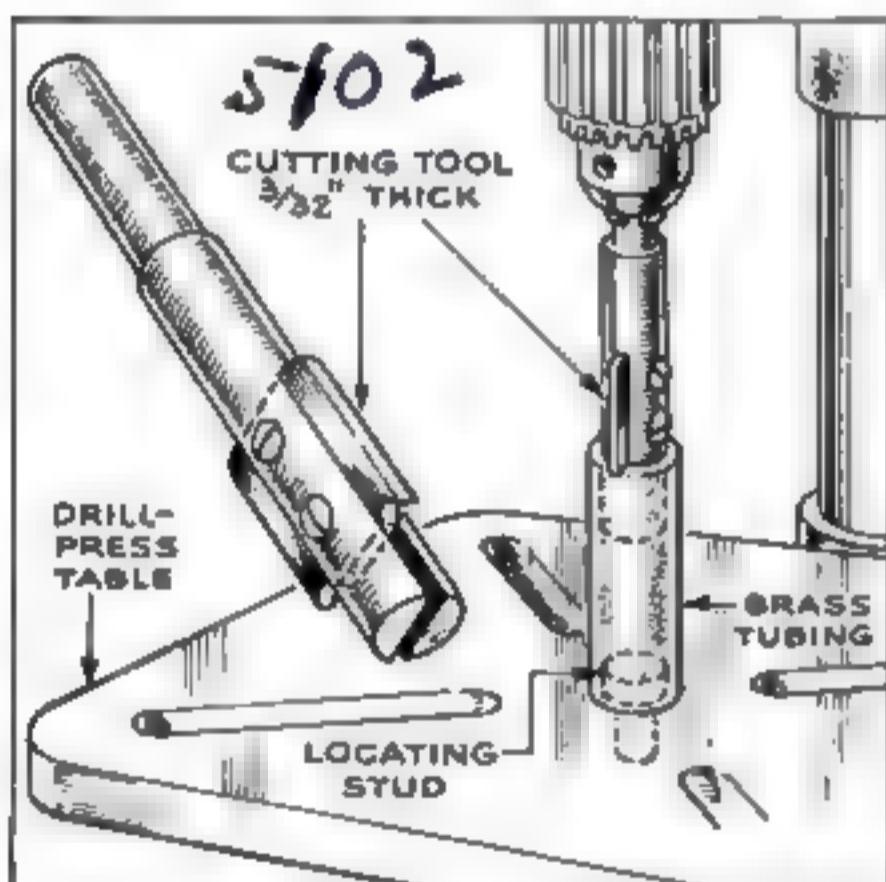
Small Objects Held by Dowel.

An excellent holder for small objects that are to be ground or polished can be made from a short split dowel. Insert the dowel in the jaws of a tap wrench. Then place the work in the slit of the dowel and tighten the chuck. Small screws also can be held in a split dowel when cutting off the heads and re-slotted.—H. Klein, Pittsburgh



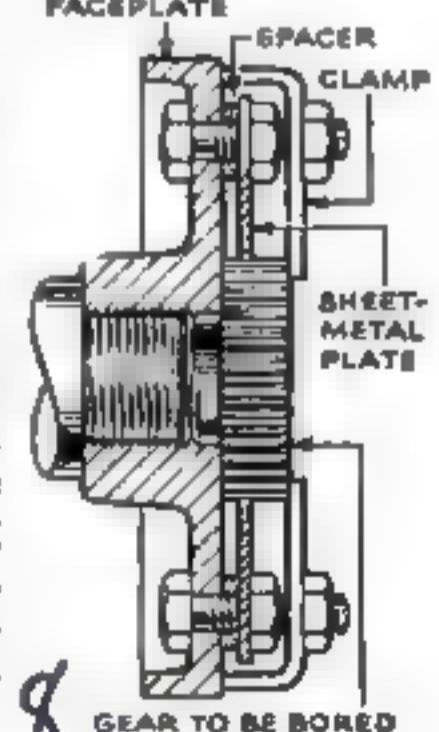
Drill Press Extended.

I modified my drill press to handle a wider variety of work by extending the drill-stand column. A 12" long pipe nipple of suitable diameter was turned and ground to exact size on the lathe. Then I made a bushing to fit the column and pressed the extension on the bushing. Now the press head can be raised 12" higher. The extension does not interfere with work on small jobs.—Carl Jean, Parker, Ind



Tool Removes Burrs. We were cutting brass tubing into short lengths and needed a tool to remove burrs from the ends. The tool we made is shown in the sketch. It is a 4 $\frac{1}{2}$ " piece of cold-rolled shafting with a 3/32" slot milled 2" from one end. Two notches with cutting edges were filed in a piece of 3/32" tool steel that was clamped in the slot. The tool was used at high speed.—Hugo Youngstrand, Chicago.

Gear Bored Without Three-Jaw. Here's an accurate method of enlarging the bores of stock gears, requiring no indicator. Using snips, cut a circle of sheet metal 1" less in diameter than the faceplate. Bolt it to the plate, using spacers. Bore a hole in the sheet metal a close fit for the gear, without any shake or play. Clamp the gear in place with extra nuts on the same bolts as shown, taking care not to loosen or shift the sheet metal.—M. Duhamel, Lachine, Que.



4438

Making Hollow Punches to Order

144

A SET of hollow punches, besides being a useful addition to any shop, is an interesting lathe project. The tools are used for cutting neat holes in many materials from thin sheet metals to leather and paper.

The most commonly used raw stock is tool-steel rod that can be hardened and tempered by heat treatment. Drill rod is excellent for most purposes. Cut the punch blank to approximate the finished tool, leaving just enough extra metal to let you face the ends. Make the diameter about 30 percent larger than the hole the punch is to cut.

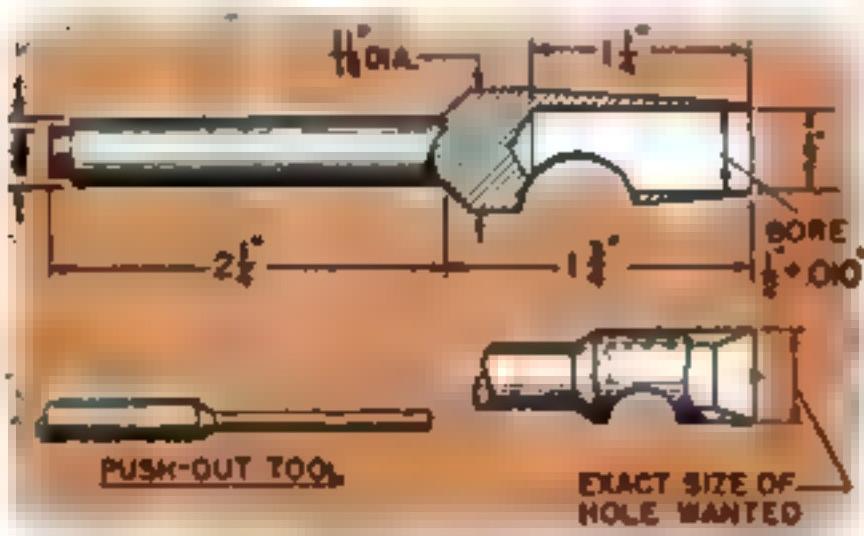
Chuck the blank so the handle portion—about $2\frac{1}{8}$ "—projects. Turn the handle to the desired diameter. I've found that $\frac{5}{8}$ " is about right for punches making 5 , 16 " holes and larger. You may leave the handle smooth but knurling gives a better grip.

A good idea at this point is to reduce the



head for $\frac{1}{2}$ " as on the punches shown on the opposite page. Such reduction retards the tendency of the end to mushroom.

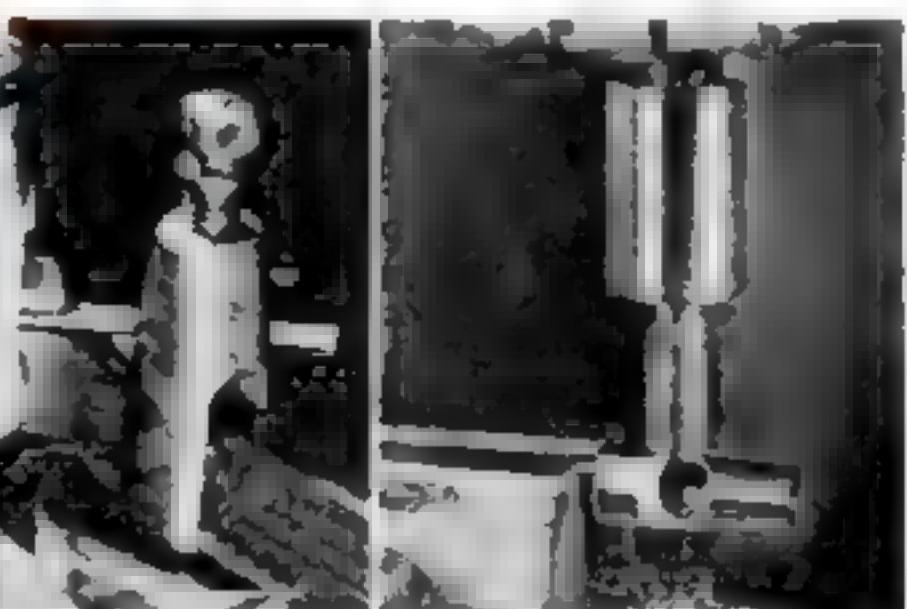
To make the cutting end, turn the blank around, face off the end, spot it with a center drill, and drill the cutting recess. Use a bit slightly smaller than the final diameter is to be. For example, in making a $\frac{5}{8}$ " punch, first drill it with a $15/32$ " bit. For the final diameter, use a boring tool. Then set the boring tool to cut $.010$ " oversize. Continue at that setting for the full length of the cutting recess. Of the two punch shapes shown, the upper one will produce uniform disks and the lower one uniform holes.



When you drill the body of a punch, use a bit slightly smaller than the hole the punch is to make. Example: For a $\frac{5}{8}$ " punch, drill it $15/32$ ".



The drilled hole is enlarged to final size with a boring bar. Also use the bar to relieve the cutting edge by making bore slightly oversize.



An end mill is used to cut the side opening in a punch. This outlet for the punched pieces may also be made by hand with a hacksaw and files.

Machine the outside of the punch body to taper to the cutting edge. The outside diameter is not particularly important as long as it is enough to give the punch walls sufficient strength. Then smooth all surfaces with a file and abrasive cloth. Carefully dress down the cutting edge but do not make it too thin.

The side opening, an outlet for the cuttings, may be made with a hacksaw and round files; or it may be cut with an end mill.

Use numbered punches or an engraving tool to mark the size on the handle or on the straight portion of the body. The finished punches pictured on the opposite page also have been marked CR or TS to indicate they were made of cold-milled or tool steel.

If you use an alloy tool steel, follow the manufacturer's directions for hardening and tempering. If you use ordinary drill rod, this procedure usually gives satisfactory results: Heat the cutting end for about $\frac{1}{2}$ " un-



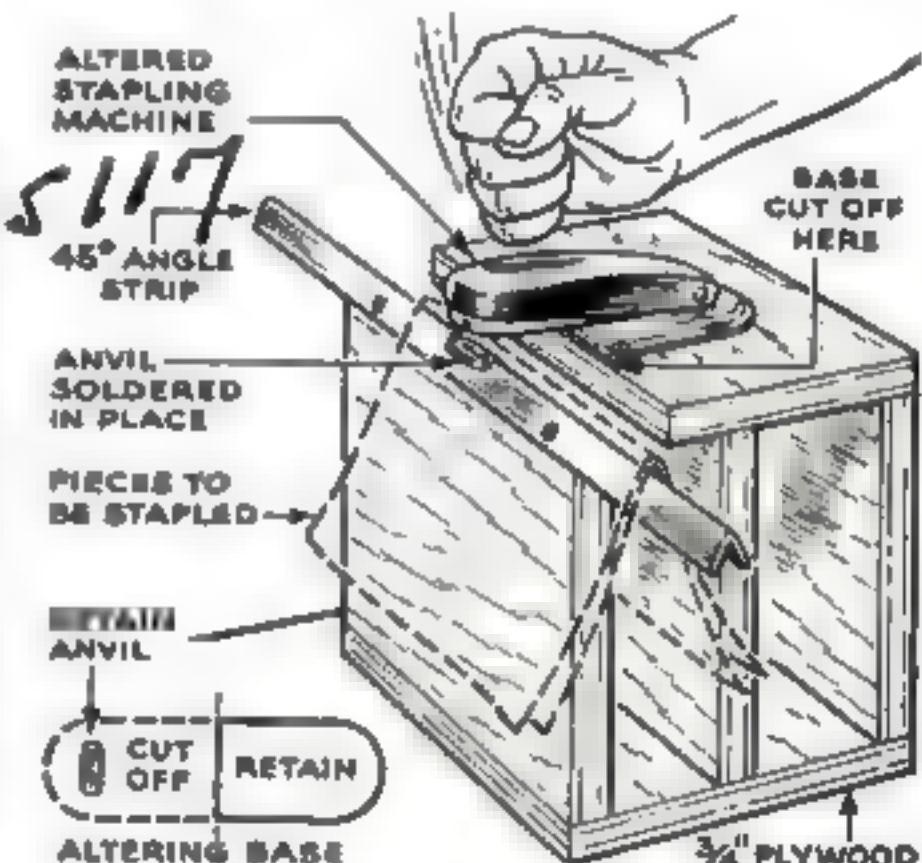
Finished punches. At left is the simplest form. Others are, from left to right, $\frac{1}{8}$ ", $\frac{1}{4}$ ", and $\frac{3}{8}$ ".

til it is cherry. Then quench in water. Polish a spot on the hardened surface and reheat slowly in a gas flame until a uniform blue film forms. Then let it cool without quenching. Harden and temper the head in the same way.—W. E. Burton, Akron, O.

Hand Stapler for Booklets

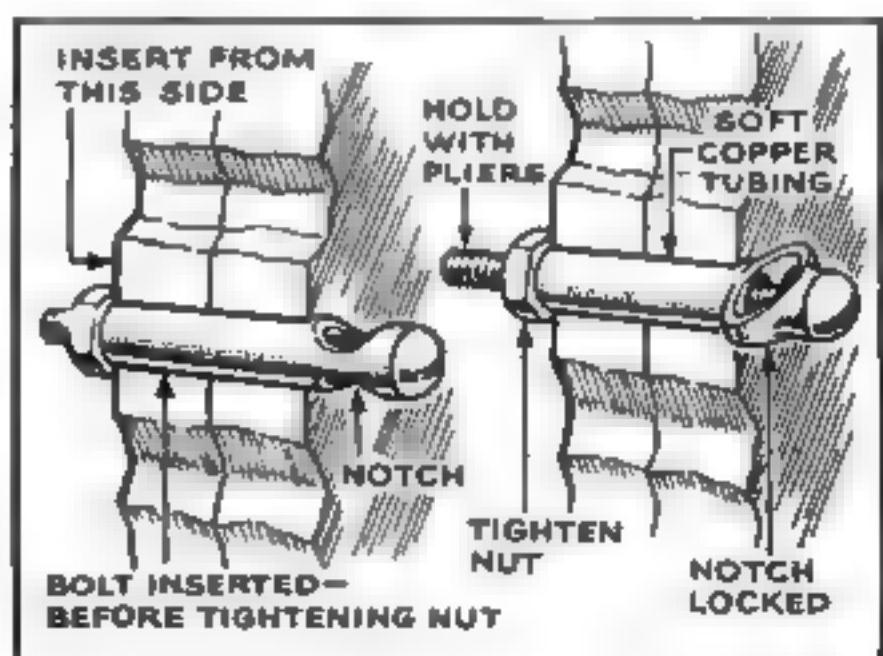
OWNERS of duplicating machines or small print shops without commercial stapling machines will find this inexpensive setup satisfactory for folders and booklets. Alter a hand stapler as shown, retaining the anvil. Solder the anvil in a recess cut in the 45-deg. angle iron. Cut the top of the front piece to accommodate the angle iron. Attach the iron with some flathead screws countersunk to let the paper slide over.

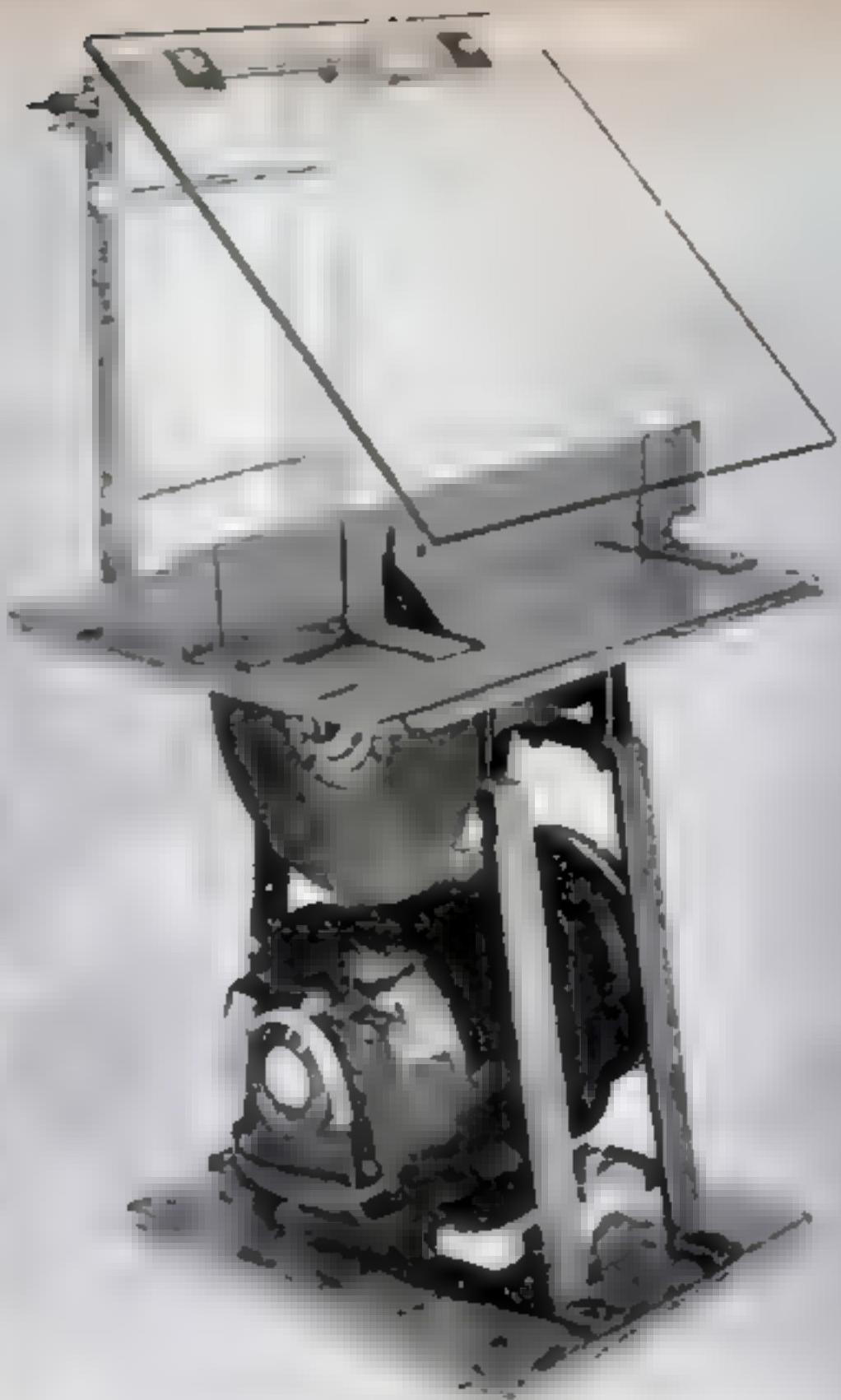
Line up the stapling machine by pushing a staple half out and moving the upper part around until the staple is exactly over the anvil. Then fasten the stapler down with screws through holes drilled in the base.—Edgar W. Ralston, Bordentown, N. J.



Tube Makes Toggle Bolt 516

HERE'S a blind bolt for attaching parts to walls, pipes, or other spots where both ends of a bolt are not accessible. Notch an appropriate length of copper tubing as shown. Insert from the notched end a slightly longer bolt with a head about the same diameter as the outside of the tube. Place this assembly in a hole drilled in the parts to be joined. Then hold the threaded end with pliers and tighten the nut until the notched end flares out and holds securely.—Don G. Pittwood, Moscow, Id.

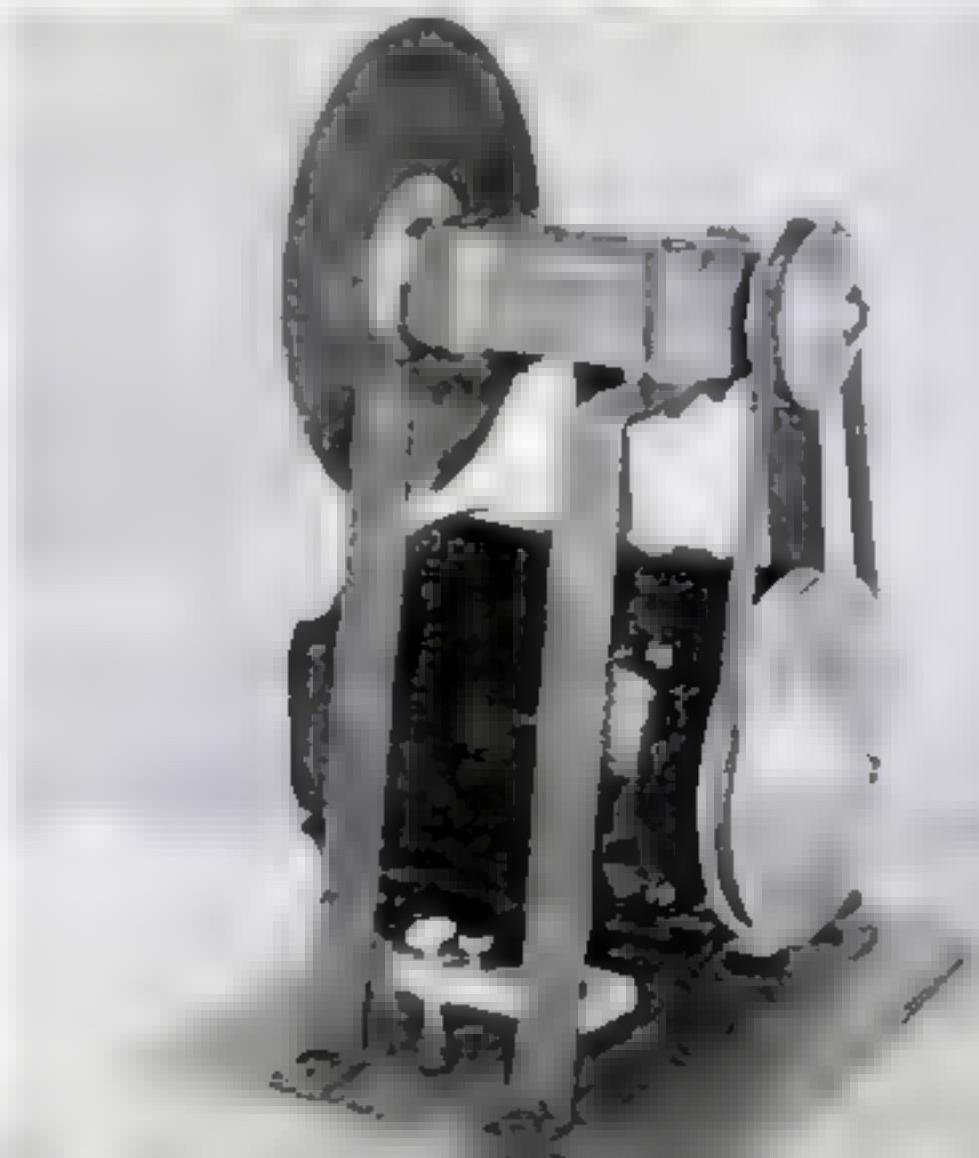
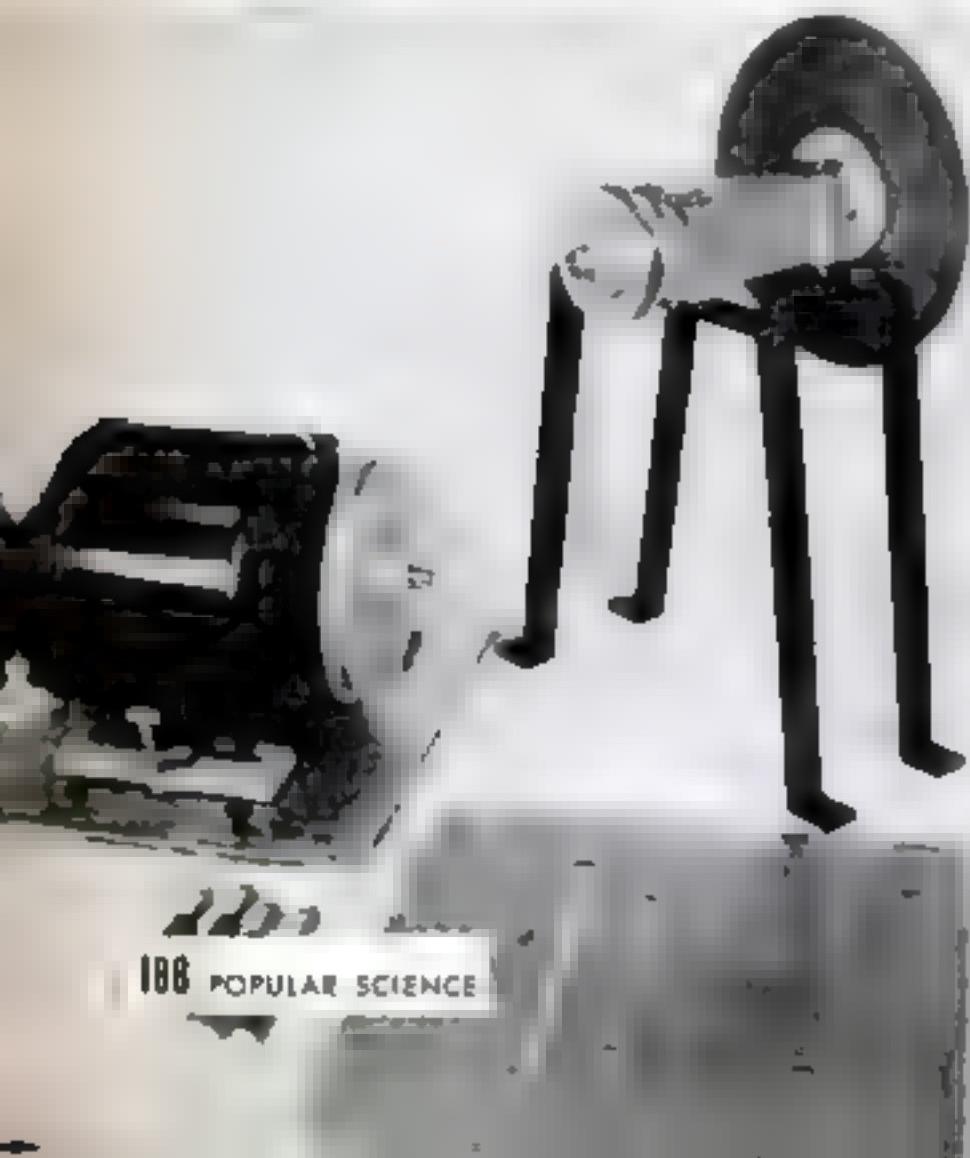




Spinning at nearly 4,000 r.p.m., the thin-edged wheel munches through almost any metal.

Disassembled, the unit's simple construction is apparent. Two pipe spacers support the table

A pivoting motor mount permits easy adjustment of belt tension. The drive uses a 22" V-belt.



Homemade Cut-Off Wheel Slices Steel

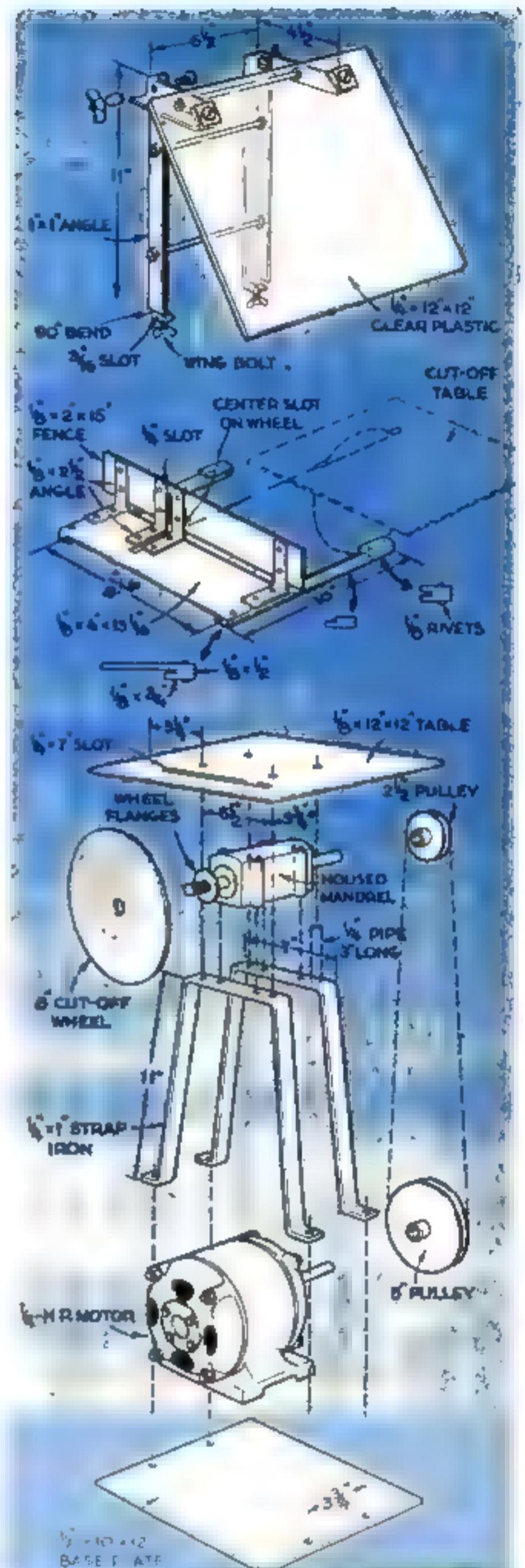
This sweat-saving shop tool will put cobwebs on your hacksaw. It'll chew through almost anything you feed it.

By Jack Mellinger 4308

IF YOU'VE recently muscled your way through a big chunk of metal with a hacksaw, you'll appreciate this cut-off wheel. The thin abrasive disk will chew its way through angle stock or pipe in a matter of seconds, leaving a smooth cut. In our shop we've also used it to trim flowerpots, cut armored cable, rough out radio panels and chassis, and whack off extra metal from castings. By rough-cutting stock before machining, it will save work time on a shaper or milling machine.

The wheel turns on a ball-bearing mandrel with a $\frac{3}{8}$ " shaft, picked up for about \$6. For power, a $\frac{1}{4}$ -hp. AC motor turning at 1,750 r.p.m. will do. Belt it to turn the wheel at 3,500 to 4,000 r.p.m. A pivoted belt-tightening type of motor base is convenient for holding the motor on the base plate. Use an 8" cut-off wheel of the type labeled for mild steel and pipe.

Most of the rest of the material is common shop iron. You'll probably want to do some hot bending with a torch or forge to shape the table supports. One way to cut the table slot is to drill two holes at the slot ends and then hacksaw out a strip between them, finishing off the edges with a file. The work guide should slide freely but not too loosely on the table, and should be slotted so that the fence can be pushed right up to the vertical center line of the wheel. It's a good plan to leave the gap shown beneath the fence; it'll let you stick a small C-clamp under the work as well as over it.





Eye protection is afforded by the adjustable shield, a clear plastic panel that's $\frac{1}{8}$ " thick.



Pushed forward by the guide, a pipe is quickly cut. The guide helps feed the work in straight.

to hold workpieces of odd or irregular shape.

A guard should be used to protect the operator, since the wheel throws grit. A panel of clear plastic $\frac{1}{8}$ " thick will do the job. The guard bracket can be clamped to either the back or one side of the table.

Unlike older rigid wheels which sometimes shattered under slight side thrust, modern rubberized cut-off wheels are not dangerous when used according to manufacturers' specifications. Too high a wheel

speed is of course hazardous, but the maximum speed is generally labeled.

Don't forget that as the wheel wears and its diameter decreases, the peripheral speed and hence the effective cutting rate will also fall off somewhat. If you aren't familiar with cut-off wheels, you may have a tendency to "take things easy" to minimize wheel wear. Actually you should feed the work into the wheel as fast as it will take it; the wheel will last longer this way. END

PAINTING ALUMINUM

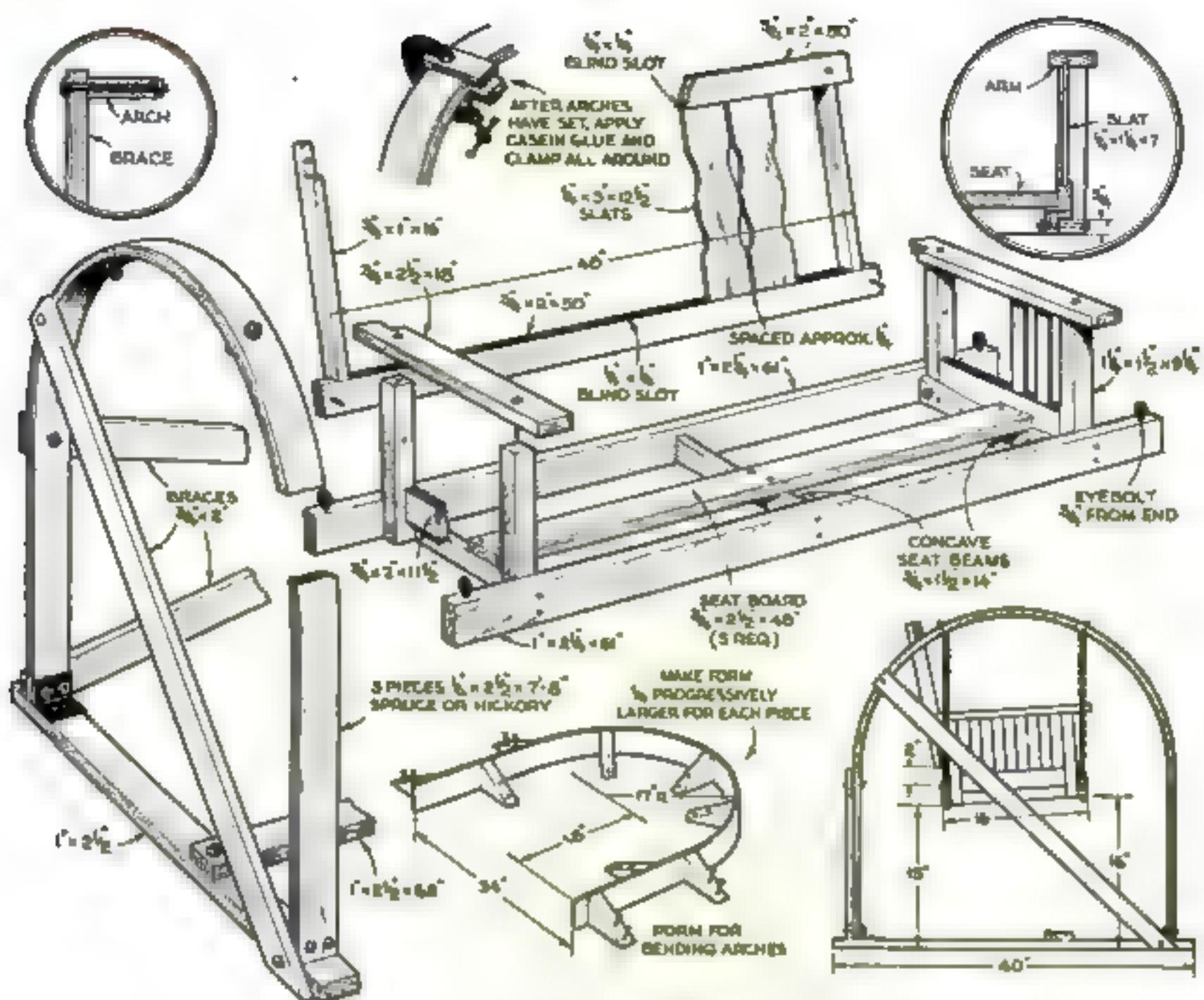
[PAINTING]

PAINT may be applied to aluminum alloys to improve their appearance and provide protection, but the surface first must be carefully prepared. Otherwise, you cannot expect a lasting job, for the paint will not reliably adhere to the metal.

In most cases, treatment of the surface with a water solution containing a little phosphoric acid and some organic grease solvents will give a good base for the paint. A solvent cleaner also may be used, but this is less effective than the phosphoric acid treatment. If the parts to be painted are constantly subjected to moisture, The Aluminum Company of America recommends use of its Alrok O_2 oxide coating to promote adhesion of the paint.

After the surface has been treated and allowed to dry, a priming paint should be applied. A primer containing a substantial quantity of zinc chromate pigment has been found to be the most effective on aluminum, particularly if the metal is to be subjected to severe climatic conditions. However, an aluminum paint made by mixing aluminum paste with a suitable varnish vehicle also will do the job. If a lacquer finishing coat is to be applied, a special primer recommended for the particular lacquer should be used.

In cases where the color is satisfactory, aluminum paint is excellent as the finishing coat because of a high impermeability to moisture. However, any finishing paint that is satisfactory for other metals may be used to good advantage. A bituminous paint is recommended if the alloys are to be in contact with an alkali-containing material, such as mortar.



2494 Porch Seat Keeps You in the Swing

THIS low-slung, comfortable swing seat will make any shady spot on a lawn or porch more inviting. It's simple enough to be built in a home workshop equipped with a circular saw; a bandsaw or jigsaw for cutting the contoured slats will also help.

In the original, each of the supporting arches was steamed and bent from $\frac{3}{4}$ " stock, but they can also be made of thinner wood. Three $\frac{3}{4}$ " by $2\frac{1}{2}$ " by 7'8" lengths of hickory or spruce will do nicely. Soak them overnight in a pond or trough and put them in a bending jig as shown until dry. The outer stakes of the form will have to be moved back $\frac{1}{2}$ " for each piece. Allow a little extra length so that the ends can be trimmed square after the laminations are glued.

Chains are hung on eyebolts, and the swing can be adjusted for maximum comfort. Note that the seat is concave with slats running end to end. Narrow slats conform best to the concave shape. The frame is

reinforced with cross braces on the back and diagonals on the arches. Screws and carriage bolts are used throughout. If the hardware is rustproof the unit may be left unpainted to take on an attractive weather stain —Hi Sibley, Nuevo, Calif.



Suspended from the arched supports, this porch seat has the gentle sway of a rocking chair.



Canvas-covered, this lightweight model takes a small outboard and has excellent stability.

How to Select a Car-Top Boat

7232

By J. A. Emmett

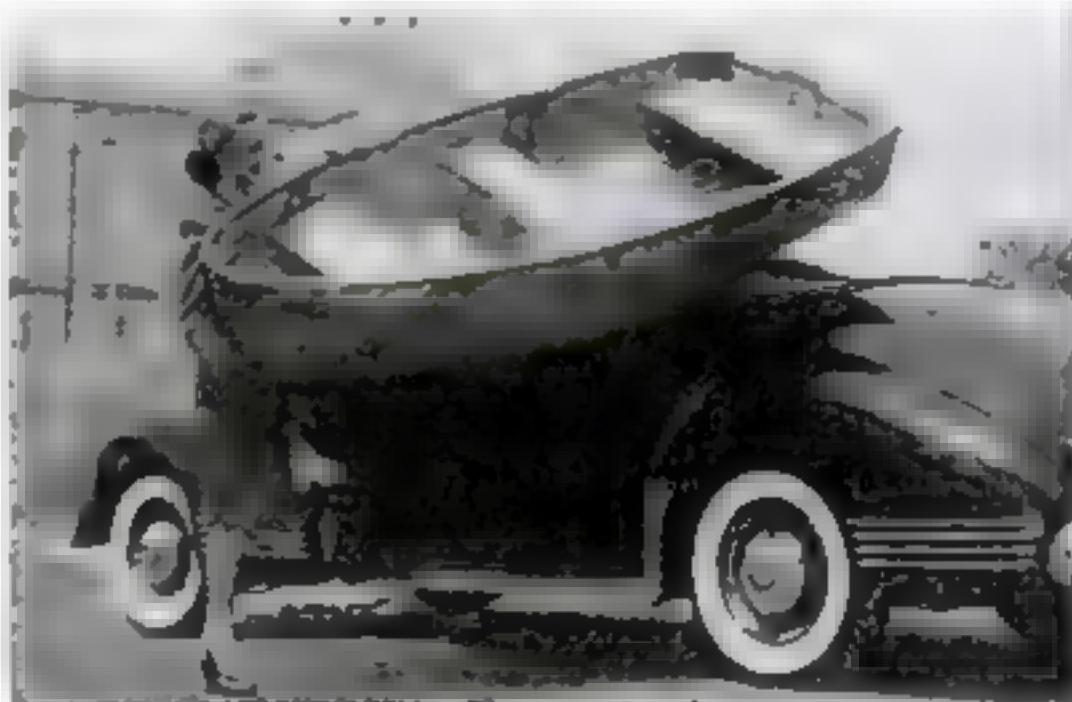
IF YOU'RE thinking of buying or building a boat for car-top carrying, here's a word of caution. You can carry any boat that's light enough for easy handling, but unless it's designed especially for such use you'll probably come out on the short end of the

deal. Just any old boat you happen to pick up will seldom give satisfaction.

Many of the new plywood, plastic, aluminum, and canvas-covered boats were developed specifically for this purpose. As any boat should, they give dependable service in the water. But over and above this, they have features ordinary boats do not



Plastic construction allows a wide latitude in design. Note the flowing lines of this model.



Easily handled, this 7' molded plywood craft weighs only 58 lb. A wide beam makes it safe

Although lightness is the primary consideration, it's by no means the only one. In most cases 100 lb. is the allowable limit. If a boat meets the weight requirement, you should also ask these questions:

Is the boat compact enough to be carried without hampering your driving?

Is the hull shaped to minimize wind resistance when overturned atop the car and at the same time retain all the stability you'll need in fairly rough water?

Will the boat withstand knocks that may occur while it's being lifted on and off the car—as well as occasional dragging when you can't drive to the water's edge?

Will the seating and load capacity be sufficient for your purposes?

Will the boat remain watertight when it's alternately exposed to the sun and soaked in water?

The ordinary wood boat practically always falls short on the latter score. For tightness, it depends to a great extent on the tendency of wet wood to swell. When it's carried in the sun, the waterproofing treatment that has been used—calking, filler, backing battens, or the shaping of the plank edges—may keep the boat usable for a while. But in time, you'll find it necessary to allow the boat several hours—or even a day or more—to swell tight. This time lapse would make the boat unusable on brief outings.

Because of the prices asked for commercial models—roughly anywhere from \$60 to \$180—you may want to build your own. Waterproof plywood offers the most practical material. The molded plywood, plastic, and metal alloy types are out of the question in most home shops, of course, and the necessity of steam-bending ribs makes

the canvas-covered boat a difficult job.

A skiff or pram model is the most likely possibility for home building. But before beginning, be sure the plans you've picked are for a true car-type, not just a boat.

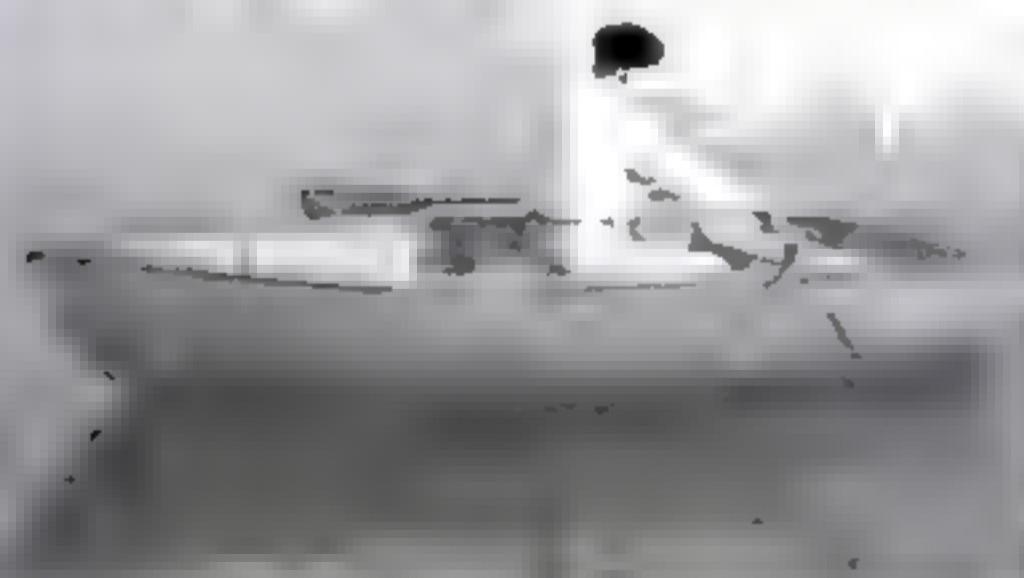
Most manufacturers who use panel plywood list flat-bottom skiffs as suitable for car-top carrying. These range from 8' to 12' with a beam of 48" to 52", the stern is usually wide enough so that the boat does not squat badly under a small outboard, and the bow is slightly fuller than the average skiff. Depending on the length, such a boat will accommodate up to four persons.

The weight may vary anywhere from 50 to 100 lb. On this point, it is important to see that the weight was not kept down by skimping on the hull framing. Despite the inherent strength of plywood, it must be properly backed by side frames and stiffened by long fore and aft members.

A pram type made of plywood also serves well, chiefly because its square bow gives a hull affording maximum load for the length. Some models are flat bottomed, others are slightly V-shaped, but in either case the bottom also is slightly rockered. Those with V-shaped bottoms are apt to be more expensive, but have the advantage of being easier to row or handle.

Although it can't be called a true car-top type, a plywood duck boat is worth considering if you want a hunting craft or an easily propelled hull for marsh use. Even in a 15' length, the weight usually is well under 100 lb. For short trips, the overhang of its low ends is not as great a detriment to driving as might be thought.

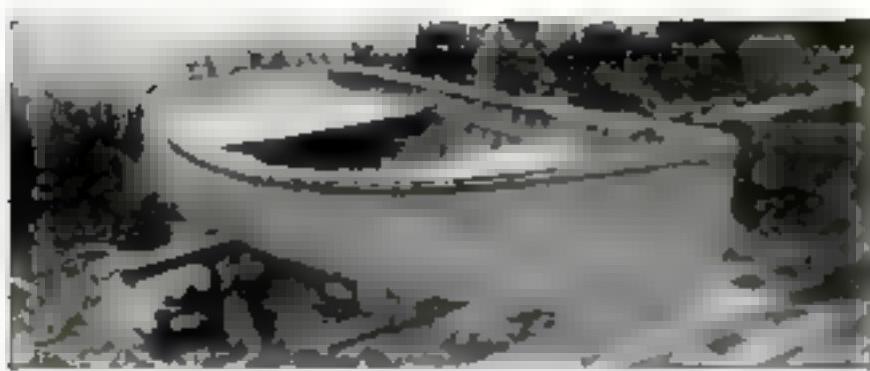
Used for years in canoes, canvas covering can be said to have first made possible a



In the water, this 12' plastic boat handles easily. Some boats of this construction tend



to be a little heavy for their size. A special carrier above minimizes the amount of lifting.



Built by the author, this canvas-covered model is satisfactory—but required painstaking work.

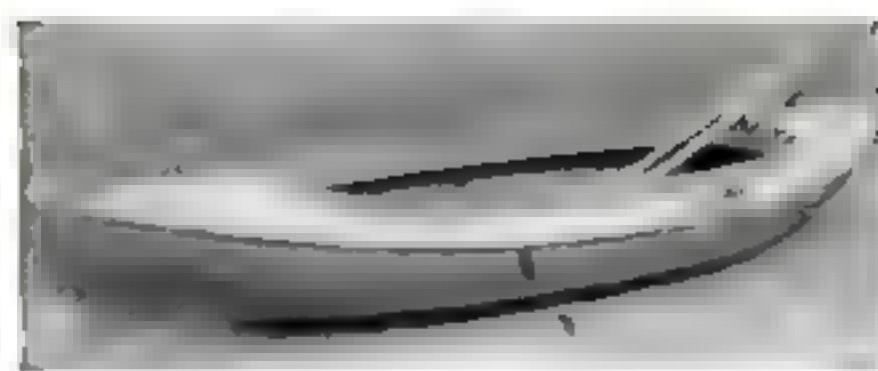
true car-top boat. Since there's greater design latitude than with wood construction, the bottom can be rounded and full lines carried well forward and aft. This gives the boat a greater carrying capacity.

Although such boats are light, they're not likely to leak or change shape even after years of service. Good workmanship and proper materials are required, however. This explains the rather high prices asked. But if the outlay is spread over the potential life of such a boat—10 or 15 years—the yearly cost is quite low.

The tendency of paint on the covering to check after a few years may be considered the only disadvantage of this type. Better builders have been largely avoiding this of late years by proper preparation of the canvas. Should the covering be torn, repairs can be quickly made with hard canoe glue and a hot iron. Moreover, if it ever should be necessary, the covering can be completely renewed by the owner.

In canvas-covered craft, there is little advantage in going below a 10' or 12' length. Anything shorter is likely to be more of the yacht type, not as easily handled in the water as longer craft.

Canoes should be considered in this bracket too—especially the short and beamy trap-



A molded plywood hunting boat like this will nestle low atop the car. It weighs about 50 lb.

ping, hunting, and carrying types and the square-sterned models designed for outboard use. A 14' modified canoe with 37" beam, perhaps fitted with air chambers to increase stability, need not exceed 100 lb.

Boats built of plywood panels should not be confused with those actually molded of plywood. Here, layers of thin veneers are laid at different angles over a master form or inside a mold, each with a coating of plastic glue. Subjected to heat and pressure, the material is molded into a one-piece shell, complete with a bonded keelson, stem, and perhaps other members.

Completing the boat is then a matter of fitting the gunwales, seats, and such members of the framework as couldn't be included in the molding. The result is a boat equal in appearance to a piece of fine furniture. In hull design, an even greater latitude is possible than with the canvas-covered type. Molded plywood boats usually have a rounded or barrel-type bow instead of the customary sharp stem.

There's great promise in small craft molded of plastic materials, aluminum alloy, and other lightweight metals. Here, there's absolutely no limit on design possibilities, and some such craft already have appeared with compound curves. It may be said, however, that this method of construction has just emerged from the experimental stage. It needs a few years of actual use for proper evaluation.

So far as metal construction is concerned, there's still an apparent need for a workable lightweight alloy that will truly resist salt-water corrosion without depending on a surface finish of paint.

Whatever its type, any car-top boat requires a good carrier or means of mounting. There are many good makes on the market, reasonably priced at around \$10. Rather than shop around, you'd probably be wise to buy a carrier from the builder of your boat. More than likely, he has chosen a style that best suits the particular type. END



If you prefer a canoe, this 18' aluminum job weighs only 38 lb. and can be carried by car.

Compact Enlarger Yields Fine Prints

It's equipped with condensers and handles any negative up to 2 1/4" by 2 1/4". Gear focusing gives vernier sharpness.

By Leonard J. Bogert,

72 Bryant Pl.
Wentwood, N.J.

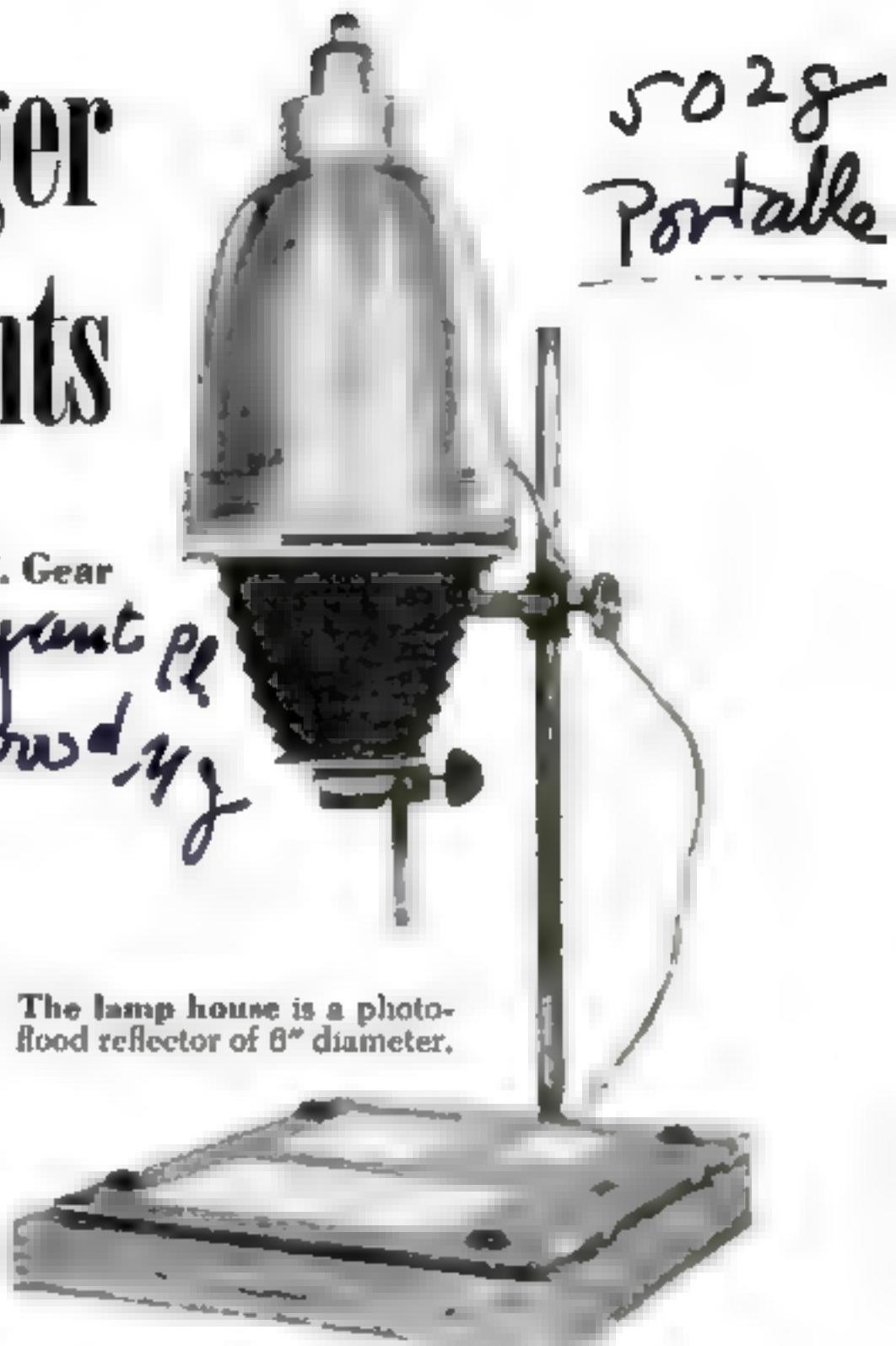
FOCUSED with a rack-and-pinion adjustment, this condenser enlarger gives consistently sharp prints. As dimensioned here, it accepts any negative up to 2 1/4" by 2 1/4". This maximum could be raised to 2 1/4" by 3 1/4", however, simply by installing larger condensers and increasing the film-holder apertures.

When you consider the prices usually asked for condenser enlargers, the cost of building this one was surprisingly low. Even if you must buy all the parts—including a lens, condensers, bellows, and a 6" photo-flood reflector—a little judicious shopping should enable you to keep the total expenditure under \$20.

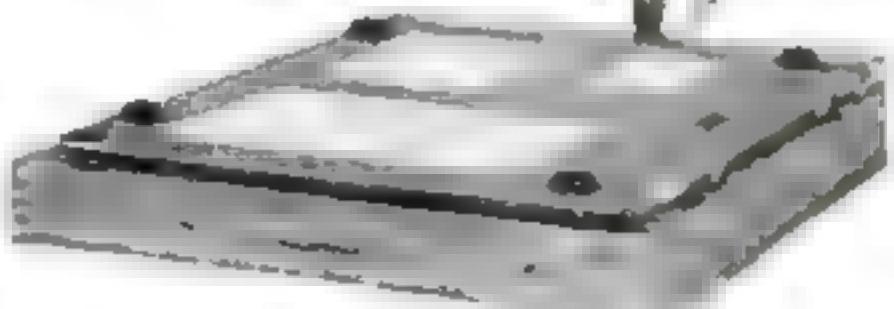
In either results or appearance, I'd stack it against most ready-made enlargers. I do considerable commercial work and, whenever the negative size permits, I invariably use it in preference to the big enlarger I bought some time ago.

There's only one construction step that might cause you any trouble. This is the job of cutting the aluminum plates, including the apertures. I licked it with a metal-cutting blade in a power jigsaw. A metal-cutting blade in a coping saw would be a good second choice. The aluminum stock, incidentally, was obtained from a radio-supply house.

Before you do the aluminum cutting, you'll need to know the end dimensions of the bellows that's to be used. As you'll see in the full-page drawing, the hole in one aluminum plate should be cut to suit the larger end of the bellows. Cement the bellows to the plates at each end and bolt the plates together.



The lamp house is a photo-flood reflector of 6" diameter.

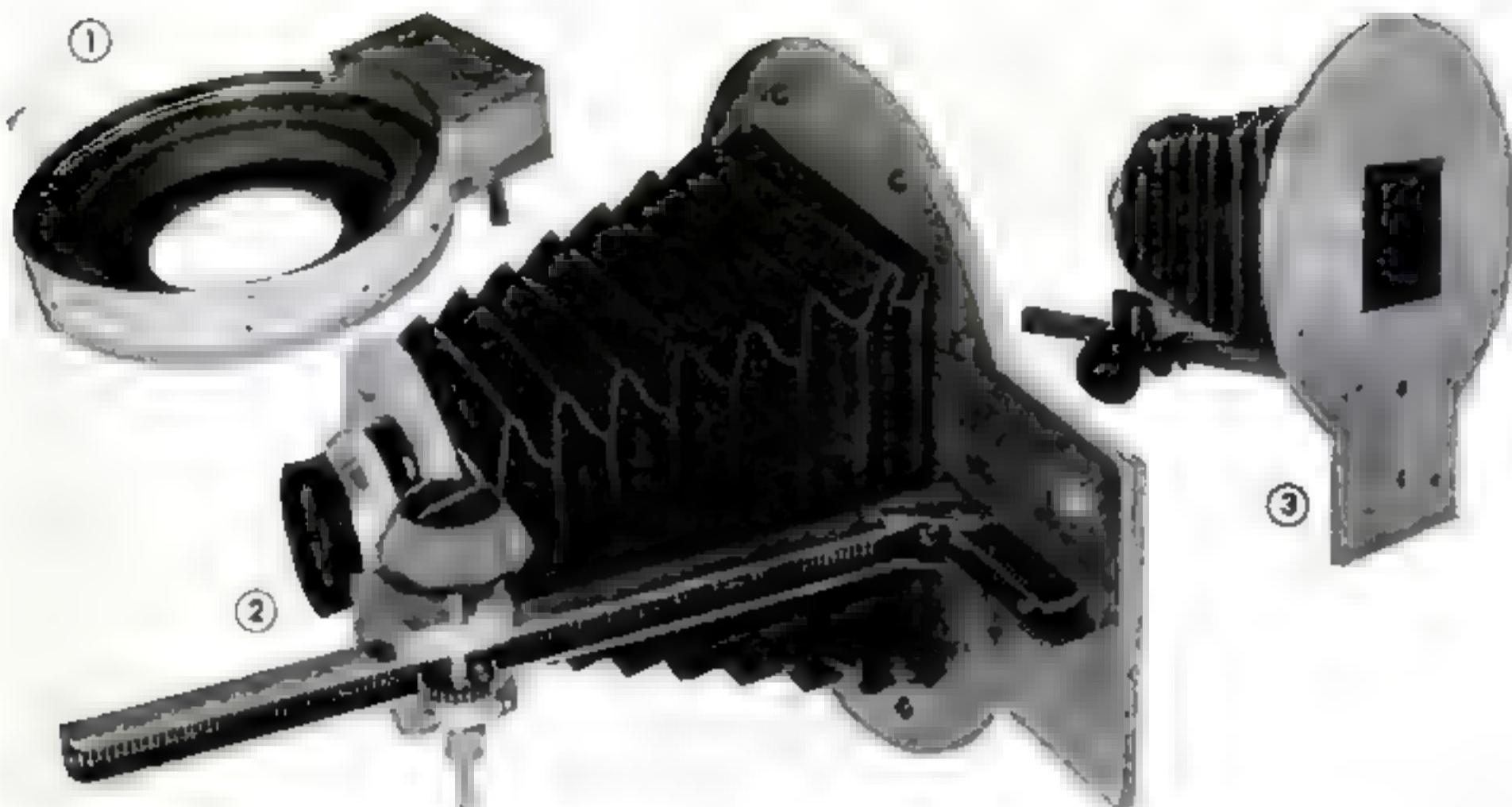


An old camera may yield a serviceable bellows. Otherwise, you can have one made at a reasonable cost.

A $\frac{1}{8}$ " plywood spacer provides a slot for the negative carrier. The $1/16$ " aluminum plate above this slot has a mating member cut from $\frac{1}{8}$ " plywood. Attach the aluminum with short, flathead screws. Countersink them so they won't interfere with the negative carrier. This aluminum plate supports the condenser unit. Hence, its cut-out should be slightly less than the diameter of the condenser mount.

Another piece of $\frac{1}{8}$ " plywood goes on top of the $\frac{1}{8}$ " plywood ring at the rear. On three sides this matches the lower pieces, but the front edge is cut out for the lamp house. The double thickness of $\frac{1}{8}$ " plywood provides a spot to attach the horizontal arm of the stand.

A band of aluminum linoleum binding 1" wide around the plywood ring has a three-fold purpose. It gives a finished appearance



A rack-and-pinion gives hairline focusing. As seen in Fig. 2, the $\frac{1}{2}$ " pinion is mounted in a plastic block, grooved to slide on the channel that carries the rack. Two short screws, with

their heads countersunk (Fig. 3), secure the horizontal arm of the channel to the aluminum plates. In Fig. 1, note how the bottom plate provides a ledge to support the condensers.

to the enlarger, keeps the lamp house in place, and acts as a light trap.

To provide ventilation, drill intake vents in the rolled edge of the reflector, both from the inside and outside. Since these are staggered, little light can escape. Also drill holes around the neck of the reflector and in the top of a radio-shield can, held in place by the lamp socket. Blacken the inside of the shield and the part of the reflector it covers, to lessen light flare.

Condenser lenses $3\frac{1}{2}$ " in diameter were used. You may be lucky enough to find a pair already mounted. If not, buy separate lenses and mount them in a tube or tin can of the right diameter. Solder in strips of tin-can stock to space them about $\frac{1}{2}$ " apart. A disk of heat-absorbent glass is optional but probably won't be needed.

For a lens I already owned a 3" f/4.5 Wollensak Enlarging Velostigmat Θ in a barrel mount with an iris diaphragm. A similar lens can probably be found by shopping the secondhand counters.

As a starter on the focusing assembly, measure 2" from one end of a $9\frac{1}{2}$ " length of $\frac{1}{2}$ " brass channel. At the 2" point, hacksaw out a 45-deg. V-shaped segment from each side of the channel. Then bend the channel exactly 90 deg. and solder on $\frac{1}{2}$ " brass triangles to keep it rigid. The short leg should be drilled for screws.

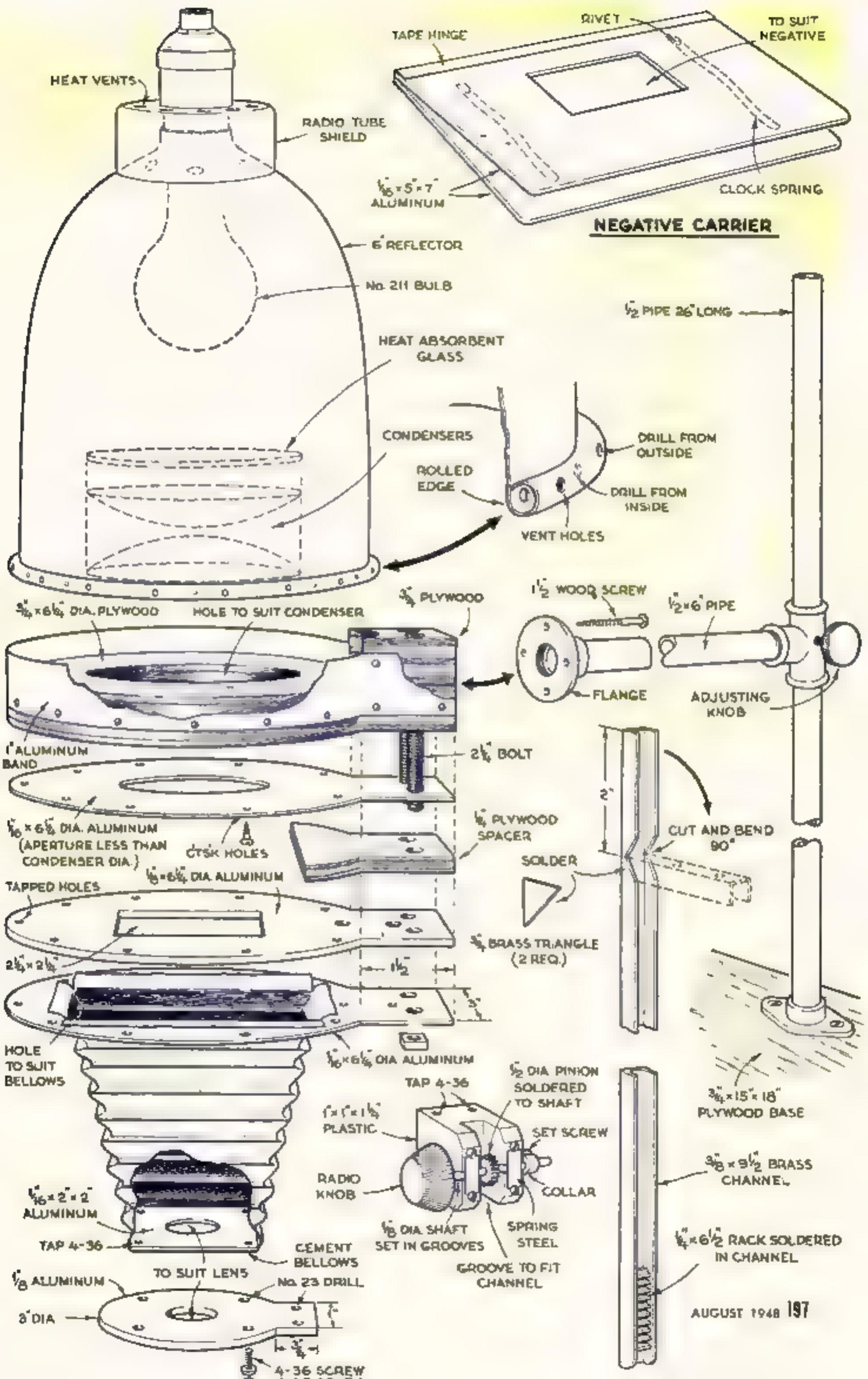
Sweat-solder a $6\frac{1}{4}$ " or 7" length of rack in the channel, being careful to keep solder off the face of the rack. Coat the inside of the channel lightly with solder, apply flux to the rack, set the latter in place, and heat the unit with a torch until the rack seats itself.

Plastic was used for the pinion-mounting block because it gives a smoother sliding action than metal to metal. Two pieces of spring steel retain the pinion shaft. Apply sufficient tension to these to prevent the pinion assembly from rolling down the rack of its own accord. Make a trial assembly before drilling the mating holes in the lens board and plastic block.

In sawing the negative carriers, locate each aperture so that the negative will be properly centered when the back edge of the carrier touches the $\frac{1}{2}$ " plywood spacer. Spring clips, indicated by the dotted lines in the drawing, will automatically keep the carriers snug in the slot.

Ordinary $\frac{1}{2}$ " pipe ($\frac{3}{4}$ " might be better) is used for the standard. A tee was converted into a slide by filing it out to an easy fit on the standard. Sweat a piece of metal to the side of the tee and drill and tap this extra thickness for a knurled adjusting screw. A weight-and-pulley counterbalance, plus a wall bracket at the top of the pipe to prevent vibration, are worth-while refinements.

END

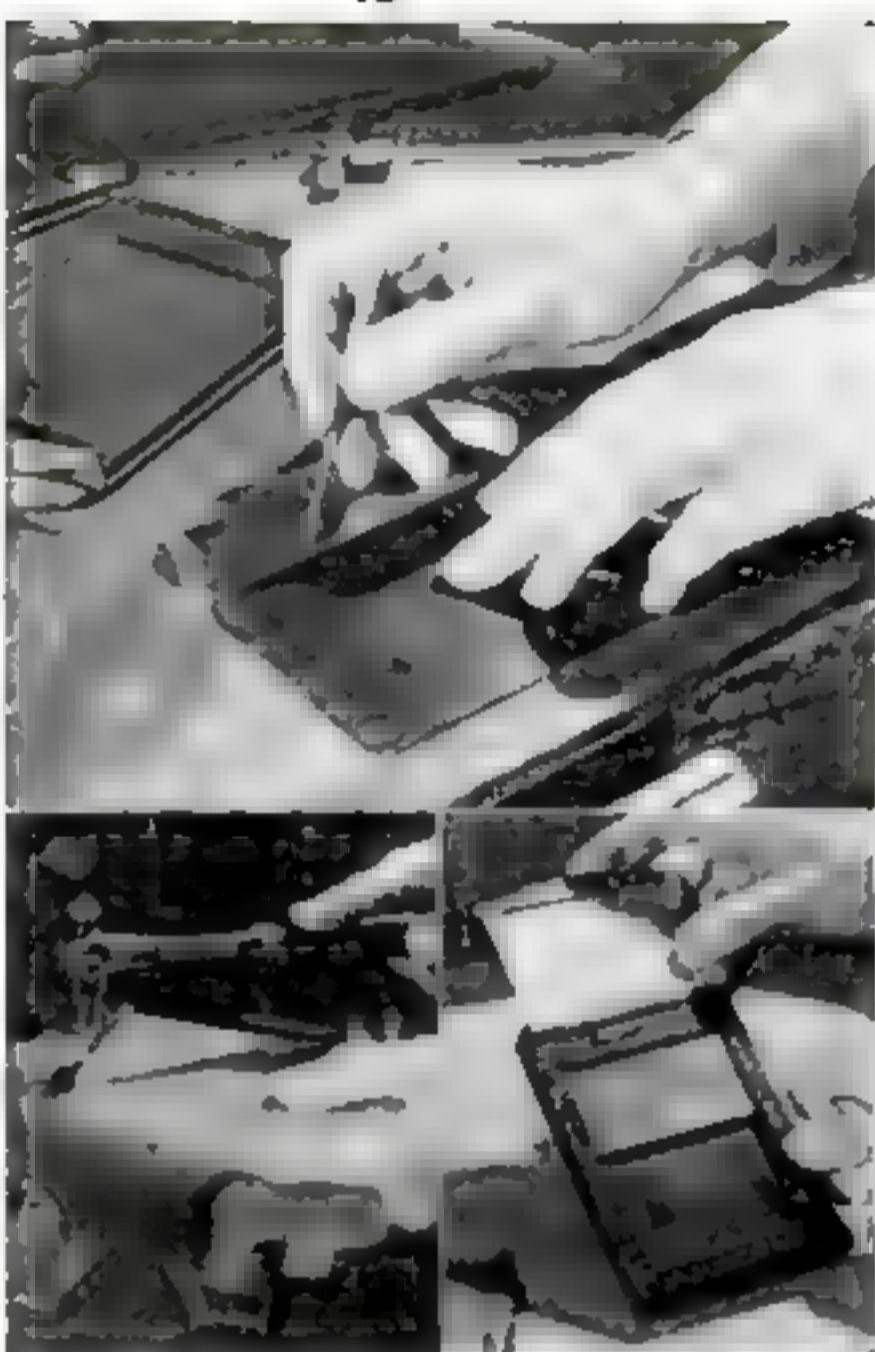




Computer Built in Camera. This new camera, offered by the Eastman Kodak Company, features a built-in exposure computer on the back. It also has a flash synchronizer and an optical eye-level viewfinder. The lens is f 4.5. Shutter speeds range from 1/10 to 1/200 second, plus time and bulb. Named the Kodak Tourist®, the new camera is made to sell for \$61.50 plus tax.



Mixing Aid. Photographic chemicals have an annoying habit of sticking to the sides of a graduate above the solution level when being shaken into it. To avoid this when mixing chemicals, form a funnel from a small scrap of paper. Use a hard-finish paper.

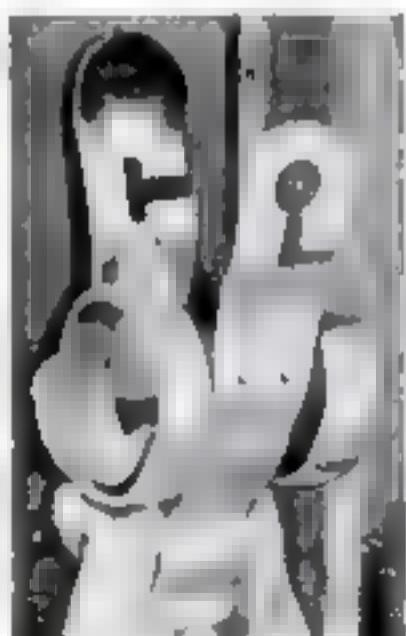


Slides Cut from Aluminum. Damaged or worn fiber slides for film holders may be replaced by new ones cut from sheet metal. I used .020" thick 24ST aluminum.

Remove the head from the old slides and punch out the rivets. Use one old slide as a pattern for marking out the new ones. Smooth their edges with a flat file and abrasive cloth, and drill the rivet holes. You can use common pins for rivets if the old ones won't do. Polish the slides with fine abrasive cloth. I've found they needn't be painted. However, if you make your slides of a ferrous metal, it will be well to paint or enamel them. —W. E. Burton, Akron, O.

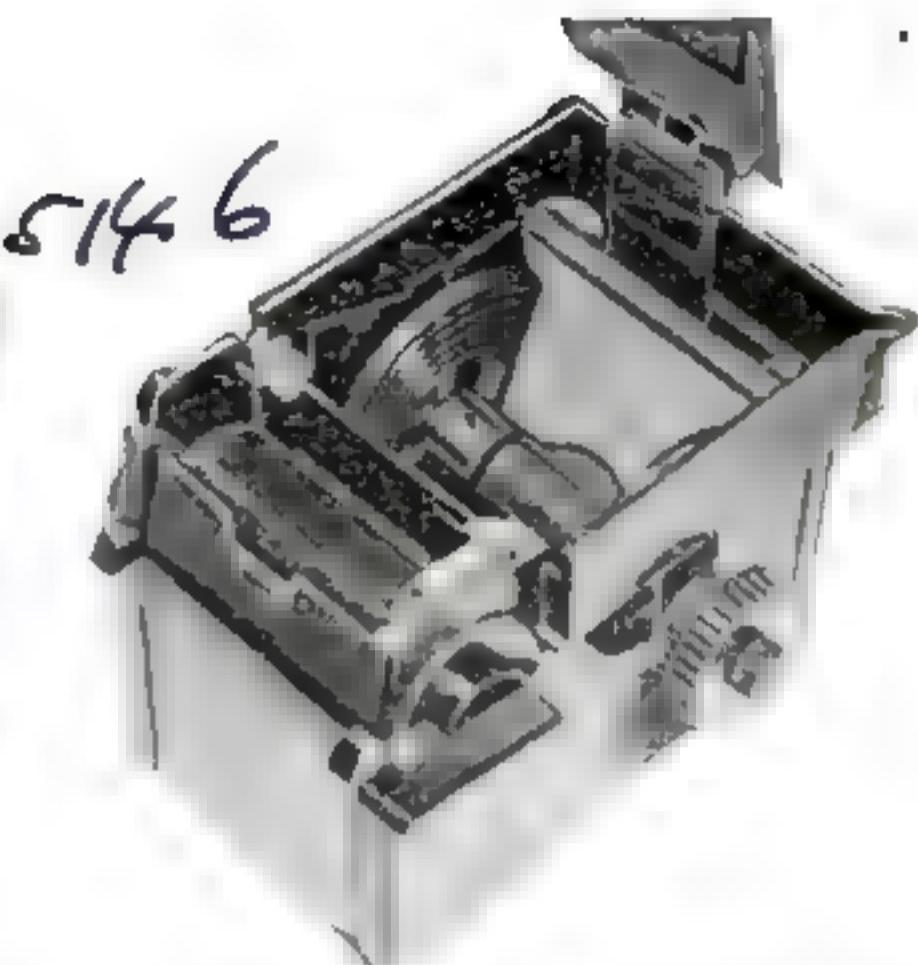
Towel Holder.

A film clip tacked or screwed to the darkroom wall or workbench makes a handy, quick-action towel holder. Equally useful is a large paper spring clip or a spring-type clothespin. The latter may be nailed to the wall.—R. F. Donovan, Jersey City.





New Tank Loaded in Daylight. No darkroom is necessary with this new tank, the Loadomat 200, offered by Photo Products, Inc., Los Angeles. After a short length of the leader is engaged in the tank's



reel, developer is poured in and the cover replaced. By turning a knob, the film then is rolled on the reel. The same knob is used to agitate the film during processing. The tank is made of plastic.

Ladder Makes Tripod. Drilling a $\frac{1}{4}$ " hole in the top step will convert a step-ladder into a sturdy stand for high angle shots. A $\frac{1}{4}$ "-20 bolt with matching nut and a tripod head are the only things you need.

As you see in the photo, the length of the bolt is of little importance. The nut can be tightened to permit just about $\frac{1}{4}$ " of the bolt to project above the step. When the picture-taking session is ended, the bolt is easily removed for normal use of the ladder. With this setup, the weight of the photographer adds to the steadiness of the camera support. Instead of a bolt, a clamp-type tripod fitting may be used.—William B. Woodington, Philadelphia.

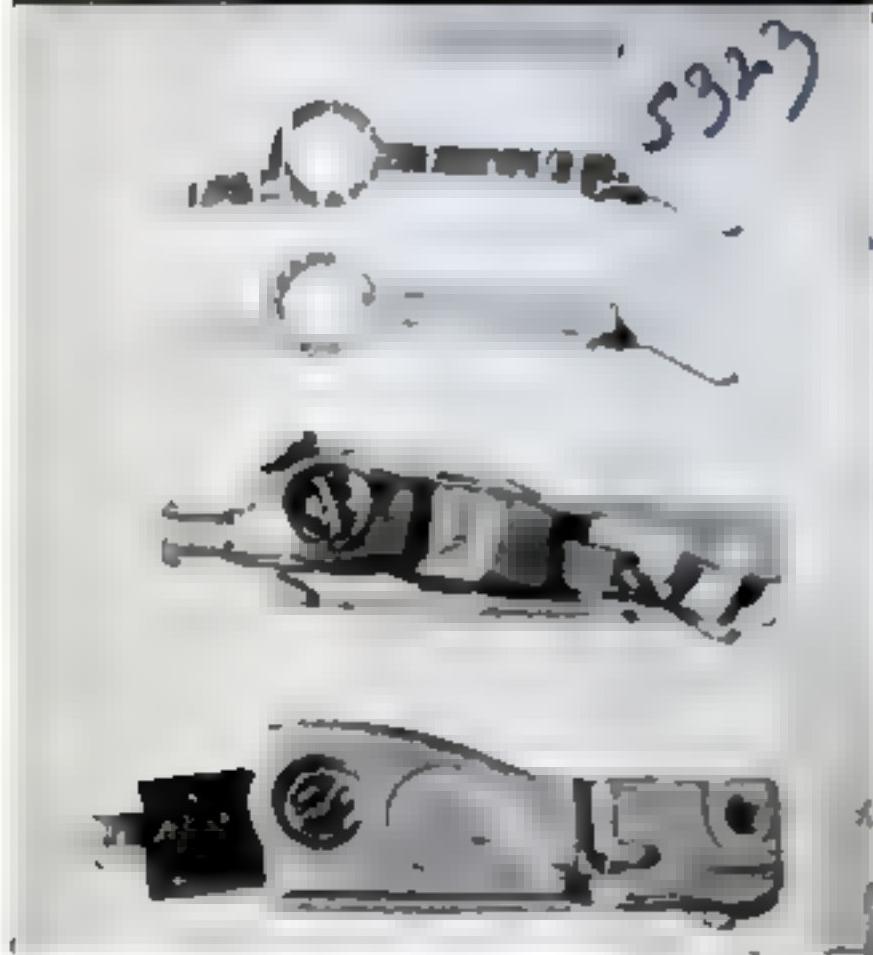


Print Washing. If the noise of water running into a tray while washing prints annoys you, wrap a large handkerchief around the faucet as shown in the photo. A towel may be substituted for the handkerchief.—George Wagenhauser.—West New York, N. J.



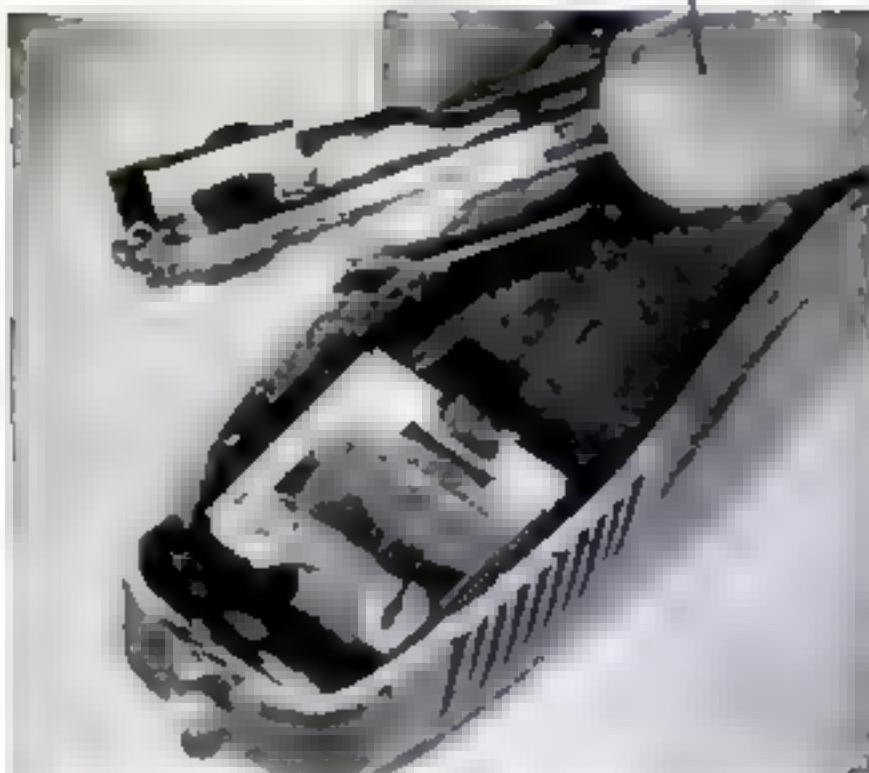
Quick Dryer. For hurry-up work, negatives may be dried in 60 seconds by washing them in a saturated solution of potassium carbonate. After one minute, remove the film and drain and wipe away the excess solution. Then polish the negative with a chamois.





Ceramic Made Piezoelectric. A polarization treatment developed by the Sonotone Corporation, Elmsford, N. Y., imparts piezoelectric properties (the ability to convert mechanical pressure into electrical impulses) to titanate, a man-made ceramic. The first application of the substance, which is resistant to heat and moisture, is for phonograph pickups. Top view shows a cutaway of the unit; below it are a small piece of the treated ceramic, a metal strip joined to a playing stylus, and the same strip with the titanate baked on. The complete cartridge is pictured at the bottom. Output and stylus pressure are roughly equivalent to crystal pickups. Frequency is said to cover the entire audible spectrum.

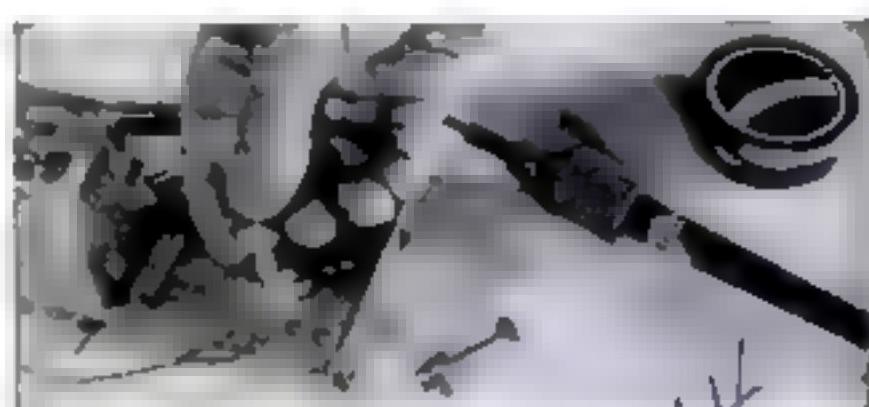
Plug Eases Socket Wiring. Stainless-steel pins on the wiring plugs shown at the right will prevent the contacts of miniature tube sockets from being pushed out of alignment or becoming clogged with solder. The plugs, made by Star Expansion Products Company, New York, come in models to fit the 7 and 9-pin miniatures.



Sprung Pickup Saves Records. Another new pickup cartridge is offered by Webster Electric Company, Racine, Wisc. It features a retractable mounting that automatically lifts the needle whenever pressure of 2.5 oz. or more is exerted. The arm can be dropped or pushed without damage to the needle or record.



Recorder Includes a Radio. This new 18-lb. package that looks like a small suitcase includes a disk recorder as well as a radio-phonograph. A single pick-up arm is used both for recording and play-back. The portable unit is made by Wilcox-Gay Corporation, Charlotte, Mich., and retails for about \$90.





Tuning Eye Makes Old Radios Think Up

Bring your radio up to date

by giving it

eye-sharp tuning plus freedom from blasting. Here's how for most receivers.

By William Norton

HARSH background noises that come through when a radio dial isn't properly set won't spoil your listening if you tune by eye. Sounds may fool the ear, but there's no deceiving an electron-ray indicator tube. When the eye squints down to its narrowest angle, you know you're on the beam.

Perhaps you already enjoy the advantages of eye tuning in your living-room console. It's easier than you think to add the same feature to those extra sets in the kitchen, bedroom, and workshop. The two main exceptions are midget TRF receivers and some

pre-1930 radios employing triode RF amplifiers. In the former case there is usually not sufficient gain to operate the indicator, while the neutralizing circuits of the latter do not lend themselves to diode detection and AVC. If your radio is not much over ten years old, the chances are that it will be a relatively simple matter to add the eye. On some older sets it will first be necessary to switch over to a diode detector before an eye can be made to operate. This procedure will be described below.

Note the words diode detection and AVC. They are the key to the whole job. Automatic volume control—AVC—consists of a condenser-resistor network connecting the



An opening for the indicator tube is made with an expansive bit. For the 6AL7-GT it should be $\frac{3}{8}$ "; most other tubes need a $1\frac{3}{16}$ " hole.

various grid-return leads of each RF or IF stage with the diode detector. The voltage developed across this network controls the deflection of the indicator eye.

How can you tell whether your set has AVC? Sets that don't have it are usually guilty of "blasting"—a sudden increase in volume as you tune from a weak station to a strong one. The reverse is also true, of course, and you'll be able to tell these older receivers by the fact that they require constant adjustment of the volume. To make doubly sure, tune in a local station and listen for background noise when the station is silent for a moment. Now turn off the station. Sets that have AVC generally show an in-



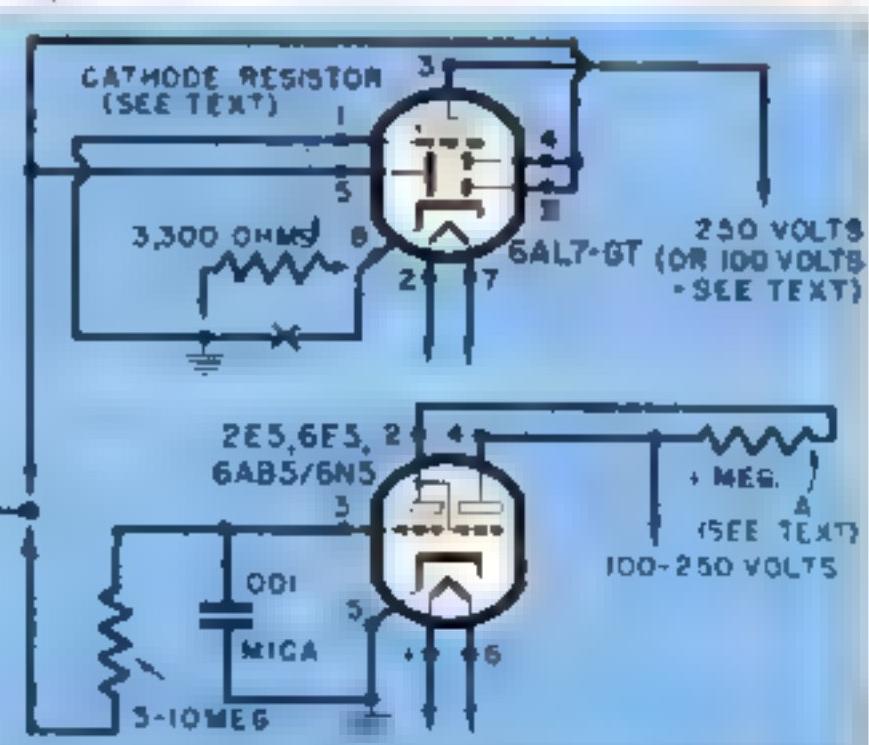
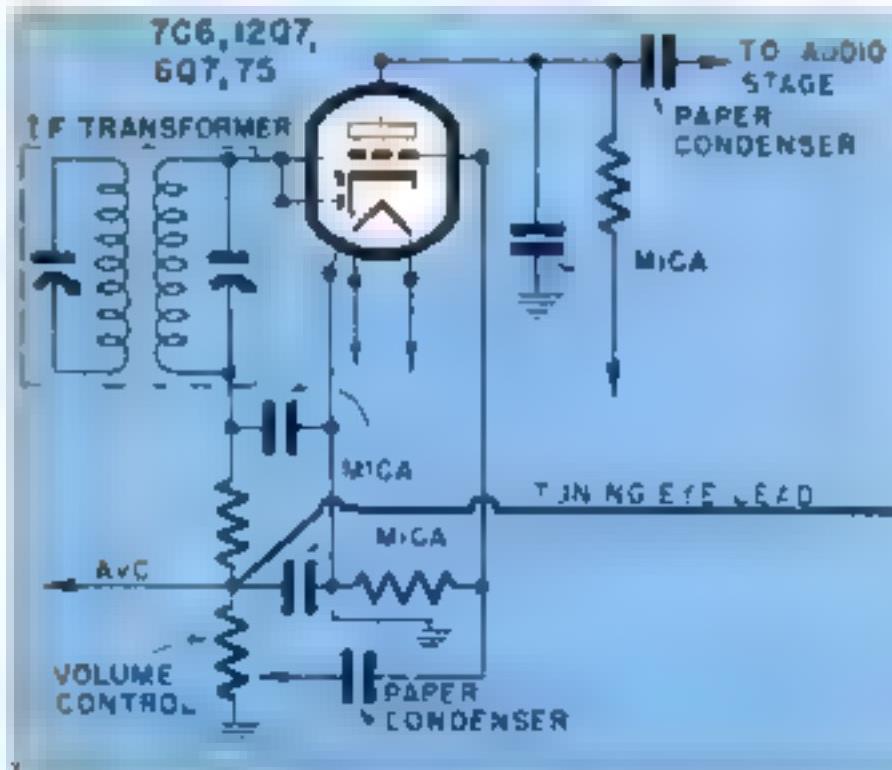
Paint the inside of the opening black to give greatest definition to the tube pattern. The decorative bezel (foreground) goes on last.

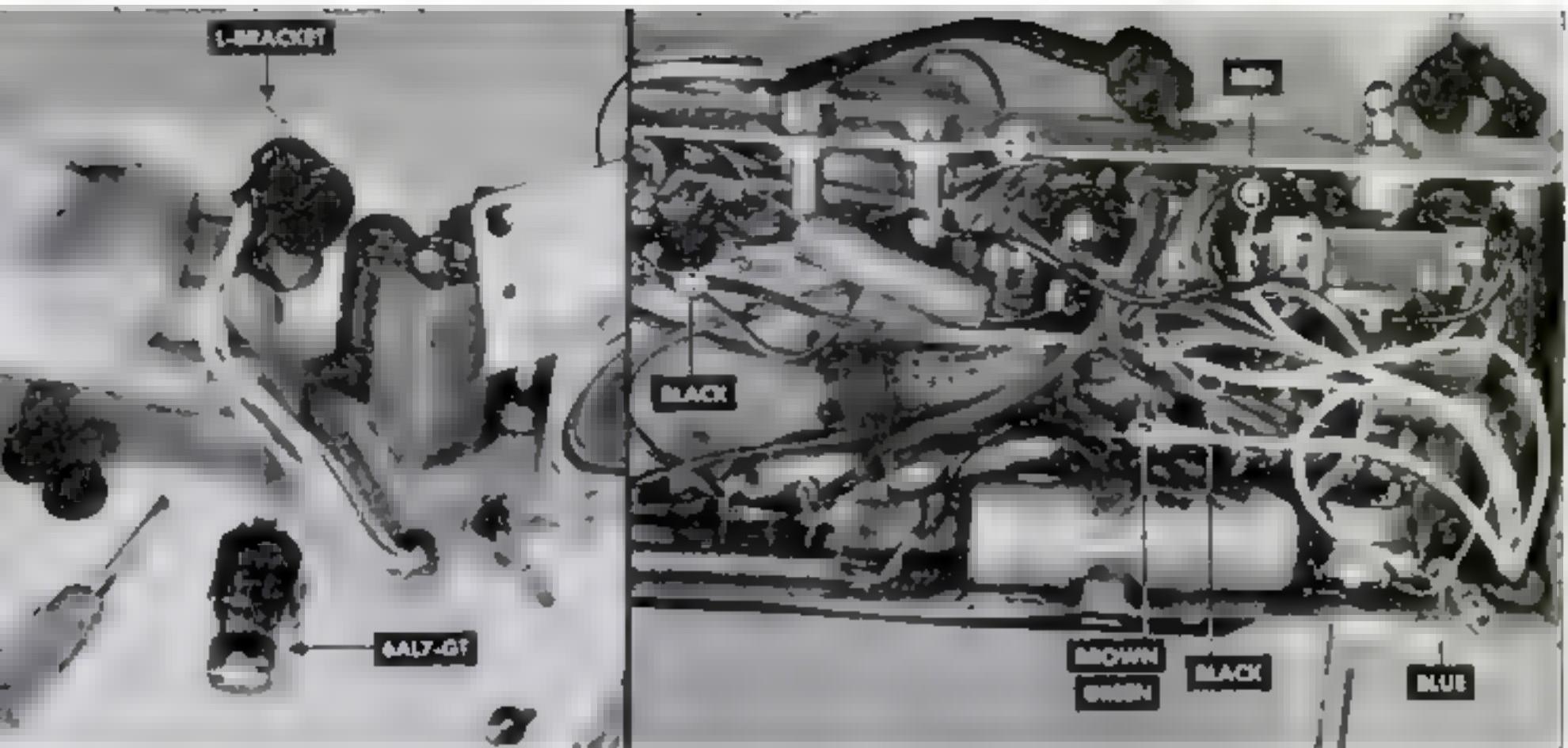
crease in background noise when the pointer is set between stations.

Take a look, also, at the table on page 205. If your detector tube is listed in Col. 1, the set probably has AVC. If you find it in Col. 2 instead, the answer is no.

Let's assume for the moment that we're dealing with one of the more modern sets. It may be an AC-DC midget or a straight AC job. If it is a midget, make sure it is also a superhet. It isn't advisable to try the conversion on AC-DC TRF's.

Now find your detector tube in Col. 1 of the table mentioned above and read straight across to the last column to find a suitable indicator tube. For some of these tubes the





An indicator-eye assembly consists of a wired socket and mounting hardware. The L-bracket was used here instead to save cabinet space.

recommended plate potential is 250 volts, but they will still glow—less brightly, to be sure—on the 110 volts available from the average AC-DC circuit.

The necessary parts for a tuning-eye assembly are generally sold in kit form. Those marketed by Amphenol ① come with additional information and circuit data. Use the 8-prong MEA8 for a 2E5, 6E5, or 6AB5/6N5; kit MEA8 will be needed for the 8-prong 6AL7-GT.

The new 6AL7-GT can be used wherever the older 6AB5/6N5 is called for. In midget cabinets the smaller size of the new tube may prove a real convenience. Should you wish to use it, the first step will be to remove the socket shield and solder together pins 4, 5, and 6. The reason for this is that the tube was engineered as an FM indicator and the deflection plates must be tied together when it's used on AM. Unlike most other indicators, the 6AL7-GT shows a flat band of light on its translucent screen. The band is at minimum width when a station is tuned in.

Only six of the eight prongs on the assembly socket are wired, and these may not be the right ones for the 6AL7-GT. If you find this to be the case, remove the extra lead from pin 4 or 5 and solder it to pin 1. Note the color coding of the remaining leads before replacing the socket cover.

Wire the socket into the set as shown at the bottom of page 202. When working on

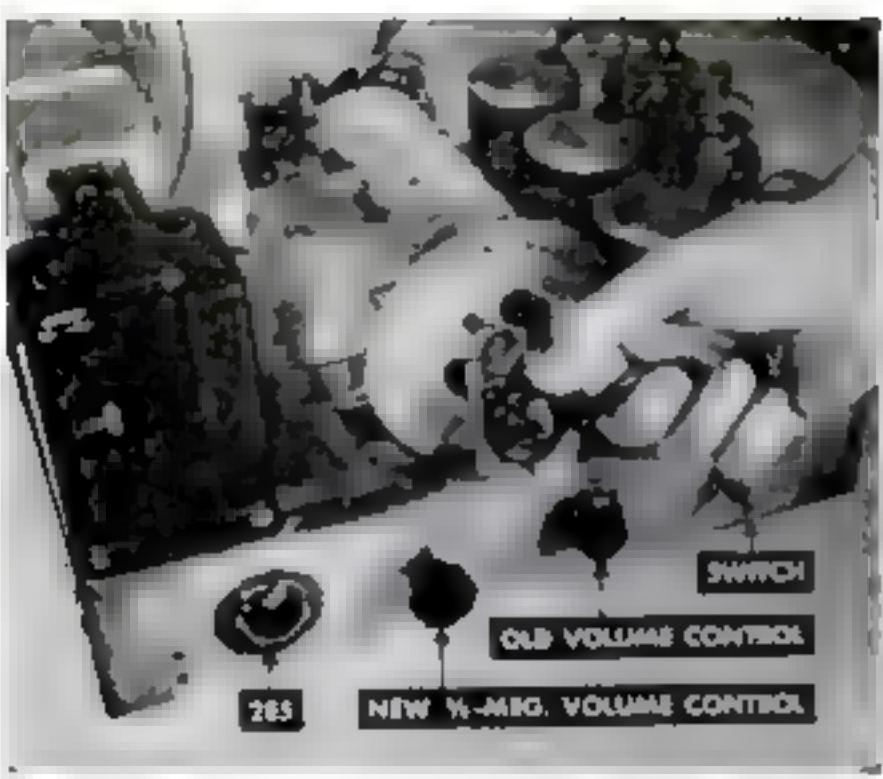
Solder the six leads as shown in the diagrams on the facing page. This 1942 AC-DC superhet already had AVC and diode detection.

an AC-DC receiver it will be necessary to open the series-filament string at some convenient point and wire the black leads from the tuning-eye socket in series with the others. On an AC set the heaters are put in parallel.

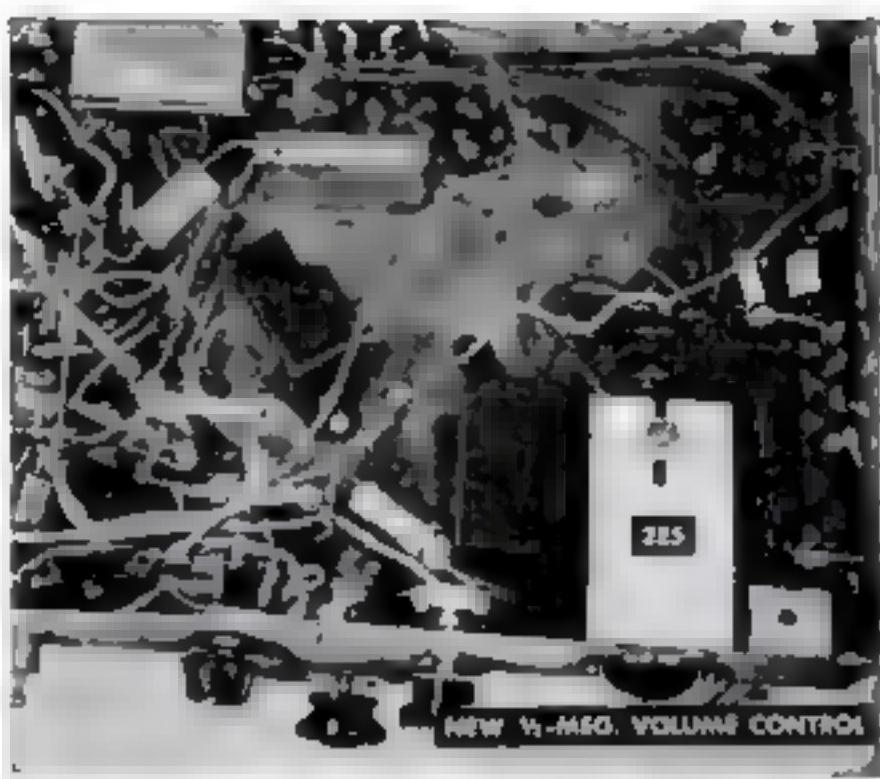
The two schematics shown at the right-hand side of the diagram should apply to most receivers, but it would be well to study your receiver for any possible variation in the AVC circuit. For example, should the eye fail to operate when connected to the hot side of the volume control, it may be necessary to try other points in the detector circuit such as the black or AVC lead of the output IF transformer.

On AC-DC sets you'll need all the voltage you can get, so run the lead from pin 3 to the cathode (usually pin 8) of the rectifier tube. Where higher voltages are available—as on AC sets—this lead may be wired to the output of the power filter. Best place to locate this is at the screen grid (usually pin 4) of the power output tube.

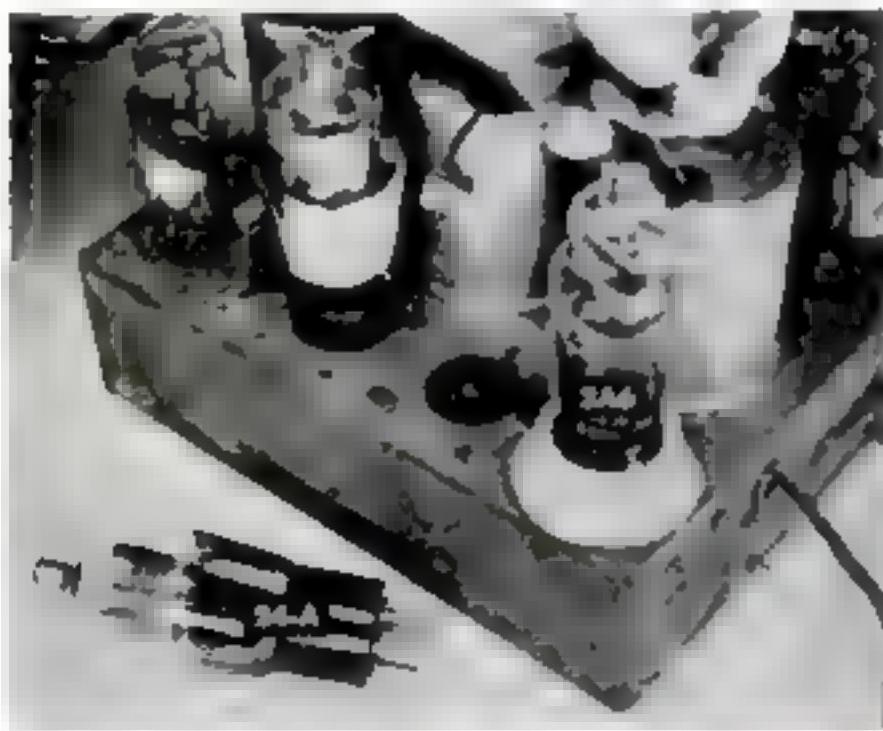
Unless the receiver uses a floating ground, the gnd lead of the 6AL7-GT (pin 1) will be connected to the chassis. However, when the chassis is not grounded, make this connection to the cathode of the detector tube. The cathode of the 6AL7-GT (pin 8) will be anchored to the same point if the set has a plate voltage of 125 volts or less—i.e., if it is an AC-DC receiver. For sets of higher voltage, use a 3,300-ohm cathode resistor and



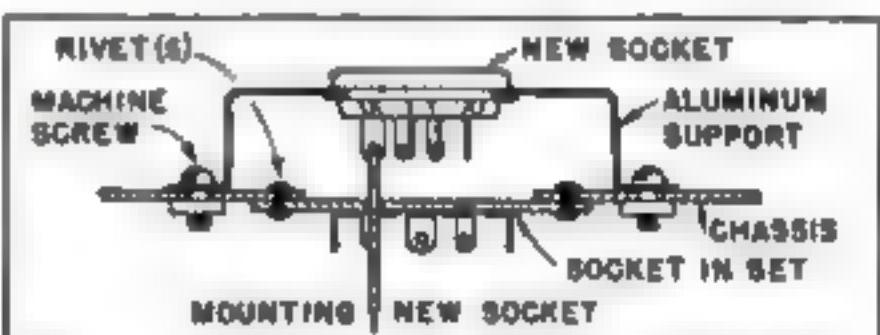
This 1931 model, 2-stage, TRF receiver first had to be altered for AVC and diode detection before a tuning eye could be made to operate.



Bottom view of the converted receiver. Note position of the 2E5 indicator and new volume control. The old control is left at maximum.

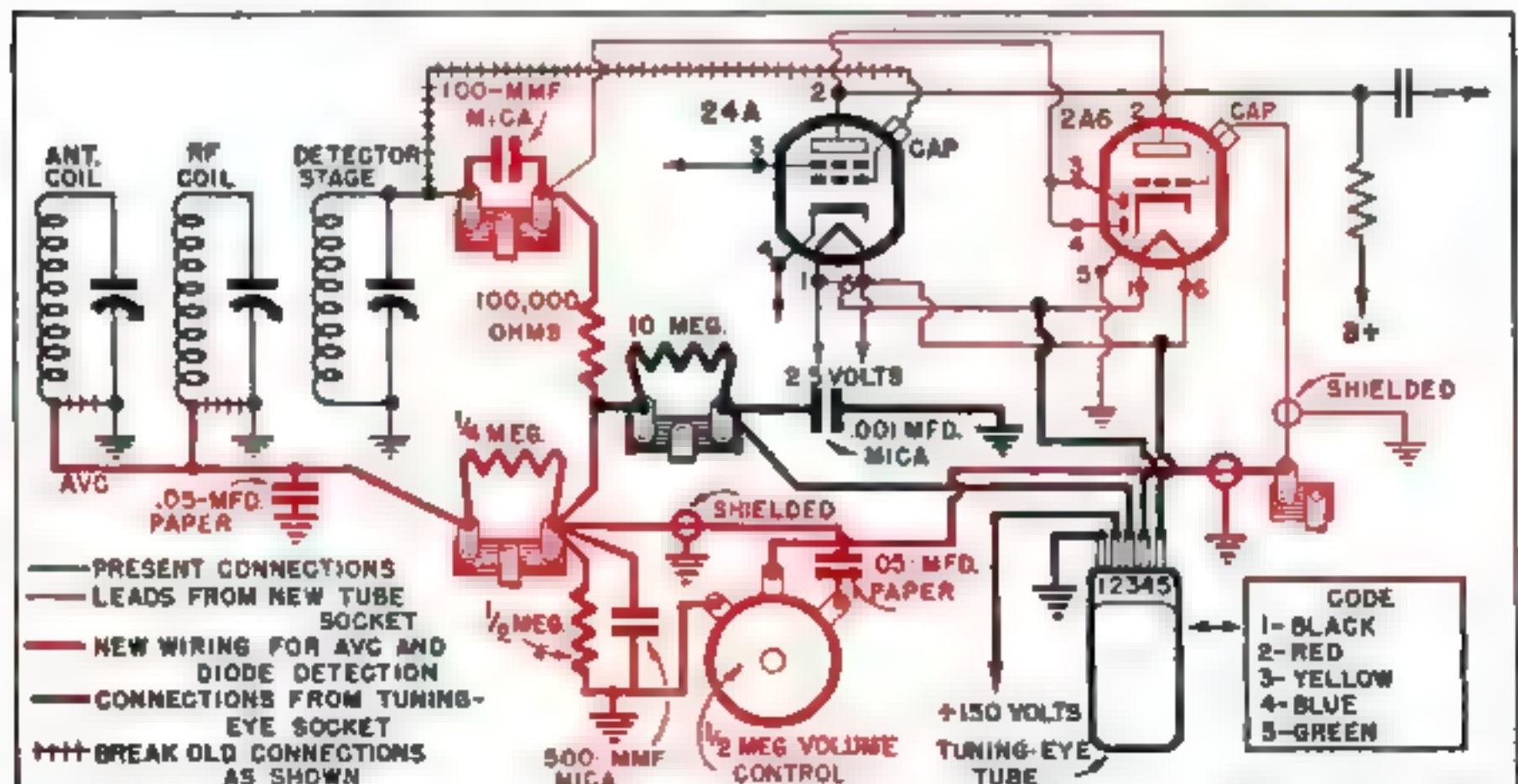


The new 2A6 diode-triode detector replaces the 24A. Its socket goes on top of the old one.



Omit the direct connection to ground (the lead marked X in the upper-right diagram on page 202).

Pins 2 and 4 of the 2E5, 6E5, or 6AB5/6N5 must be connected through a 1-meg. resistor (marked A in the lower right-hand diagram, page 202). If you use a kit you may find this resistor already included in the socket.

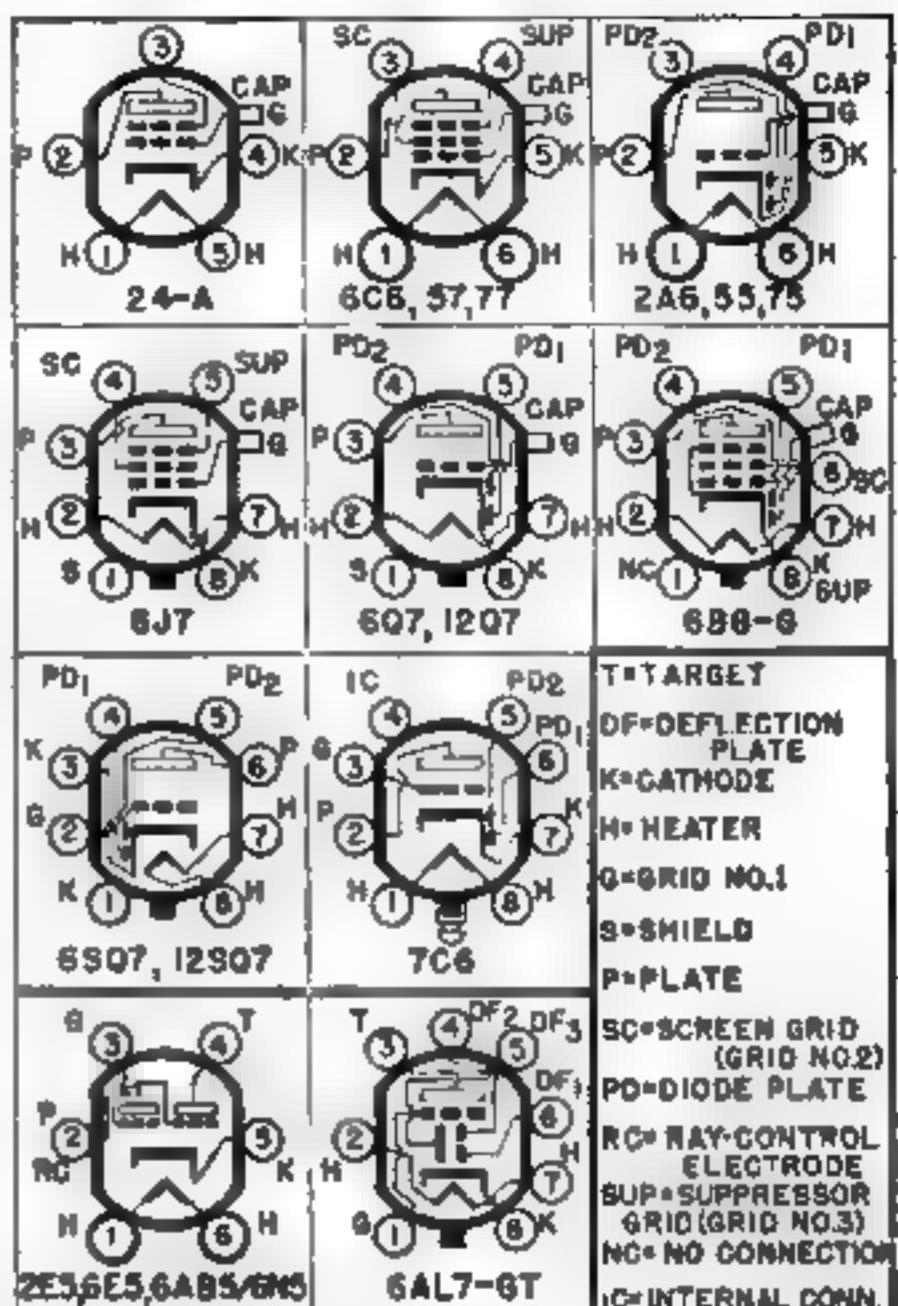


Fewer than a dozen wired connections are needed to add an eye to a set that has AVC. But what about the other ones? Here the job is slightly more complex, but it is even more worth while in terms of improved performance. Adding a diode detector and tuning eye should reap dividends in improving tone quality as well as ending blasting and off-station tuning.

The converted set shown here is an antique (1931), two-stage TRF receiver. It used a 24A for a detector, and this first had to be replaced with a 2A6 diode-triode. A new 6-prong socket was placed on top of the old 5-prong one by means of a flanged aluminum support. Wood or metal spacers about 1" long could have been used instead. Five wire leads, each 6" to 8" long, are soldered to the contacts on the new socket (pins 3 and 4 are joined and require only one lead). These are pushed down through the holes in the old socket and wired into the circuit as shown by the light red lines in the diagram.

Unsolder the clip from the old grid lead and pull the wire through the shielding can to the underside of the chassis. Bolt three or four fiber mounting strips to the chassis to serve as tie points for the new wiring and add the extra resistors, condensers, and volume control as shown. The new grid lead must be shielded; this can be done by using braided wire or by bringing it up through the shield can of the detector coil. Color coding for the tuning-eye socket refers to the MEA8 assembly as used with the 2E5 tube. The grounded lead, 1, is the cathode; 2 is the B-plus lead from prongs 2 and 4 which combines the target, plate, and ray-control electrode; 3 is the grid connection, and 4 and 5 supply current for the heaters.

With three or more shield cans on top of a TRF chassis you may have some trouble



For convenience the base connections (bottom view) of most detector tubes are shown above.

identifying the various coils. The job isn't made any easier by the fact that the same tetrode was often used in the first and second RF stages as well as the detector. This set, for example, had three 24A's

Some tracing is therefore necessary. Life will be made simpler if you can find a circuit diagram of the set, but it isn't imperative. To find the antenna coil trace the antenna lead-in wire under the chassis. It will probably go—either directly or through a volume control—to one section of a ganged tuning condenser. A wire connects this condenser section to the antenna coil, and this coil is linked to the grid cap of the first RF tube.

The second section of the ganged tuning condenser will most likely be joined to the second RF tube in the same manner. That leaves only the detector stage to account for. This may be further checked by looking for a fixed resistor and condenser (in parallel) from the cathode of this tube to ground. The detector tube is also coupled through a condenser to the first audio tube, which will in all likelihood be of a different style—type 27 or a similar tube.

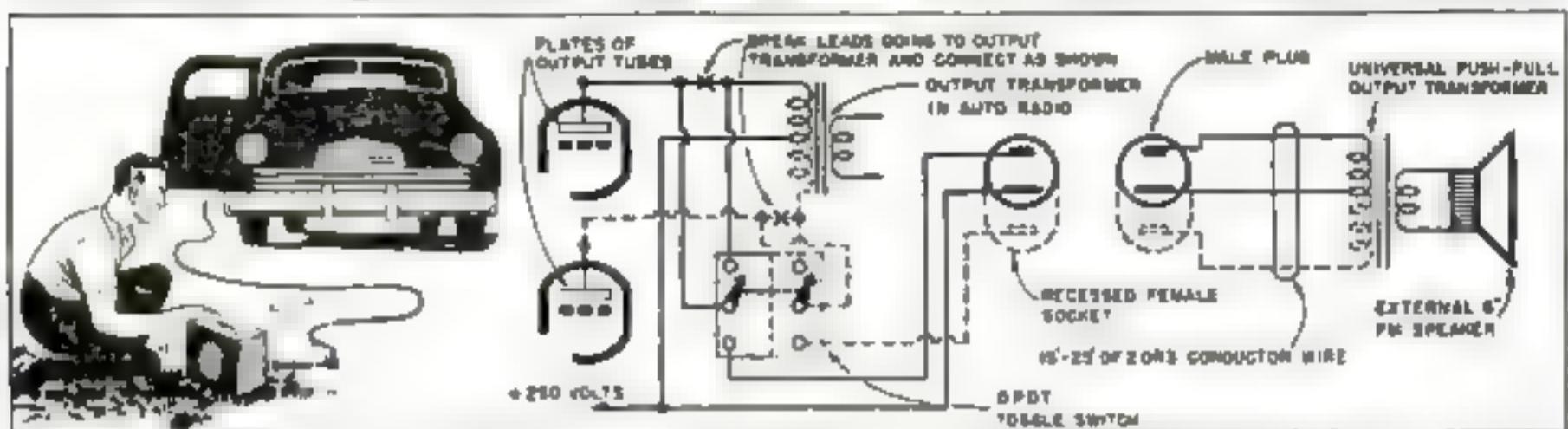
END

| Receivers with these standard detectors probably have AVC | Receivers using these tubes as detectors do not have AVC | Replace tubes in Column 2 with these detectors | Get info from kit wiring | Get info from kit service manuals | Use the recommended tube |
|--------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------|-----------------------------------------------|--------------------------------|
| 2A6 | | | 2.5 | 0.0 | 2E5 |
| 6Q7 | | | 6.3 | 0.3 | 6E5 |
| 6S07 | | | 4.3 | 0.3 | 6E5 |
| 7C6 | | | 2.0 | 0.25 | 6AB5/6N5* |
| 12Q7 | | | 12.6 | 0.15 | 6AB5/6N5 |
| 17S07 | | | 12.6 | 0.15 | 6AB5/6N5* |
| 55 | | | 2.5 | 1.0 | 2E5 |
| 75 | | | 6.3 | 0.3 | 6E5 |
| 24A | 24A | 24A | 2.5 | 0.0 | 2E5 |
| 6CB, 57 | 6B9 | 6B9 | 4.3 | 0.3 | 6E5 |
| 6J7 | 6S07 | 6S07 | 6.3 | 0.3 | 6E5 |
| 57 | 7A6 | 7A6 | 2.5 | 1.0 | 2E5 |

*The new 6AL7-6T can be used in place of the 6AB5/6N5.

5255

External Speaker Adds Uses to Your Auto Radio



GIVE a loudspeaker enough cord and you can hang it on a nearby limb or simply place it on the ground beside you when you get out of an auto to loll in the shade. For those many times when you are just far enough away from a car for its radio to be of no use, this extension speaker is the perfect answer.

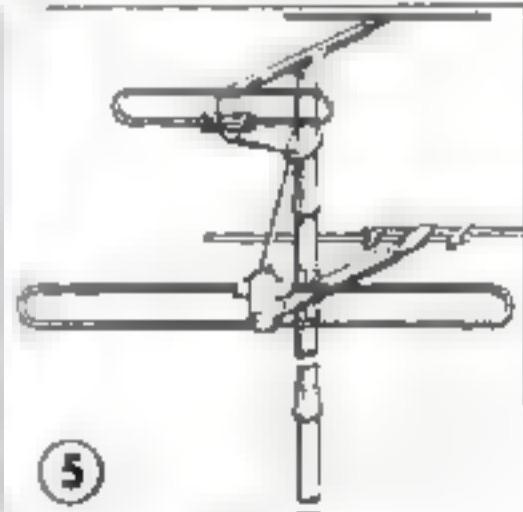
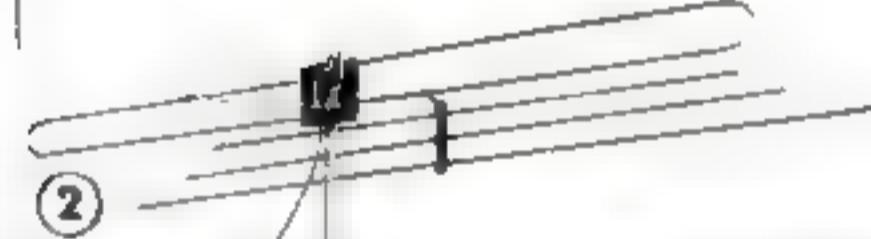
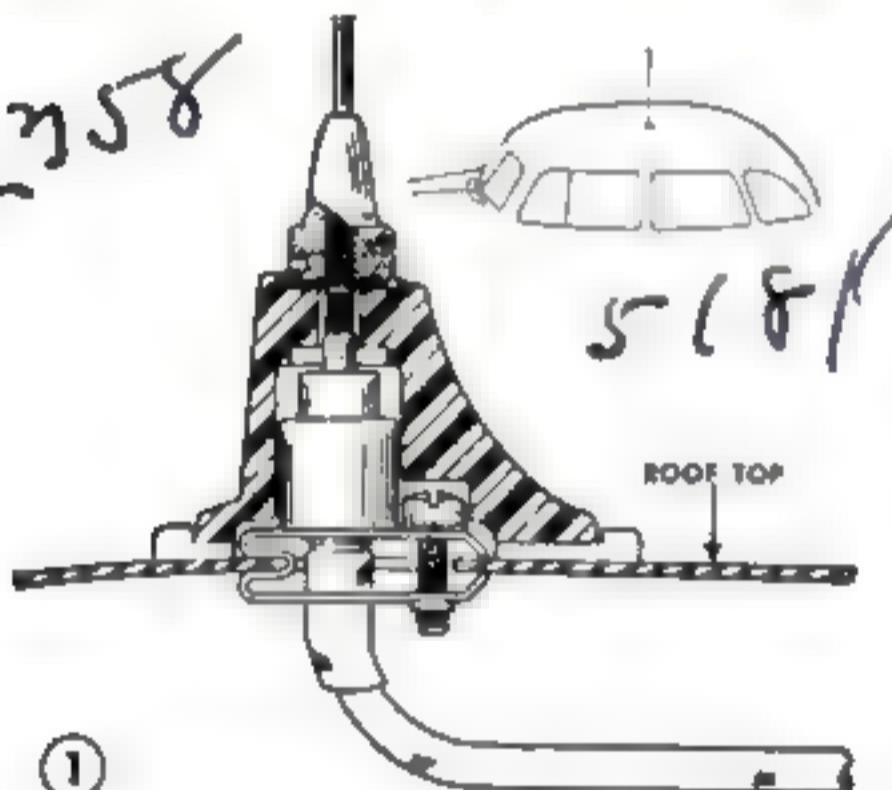
The toggle switch makes it possible to change instantly from the internal to external sound. Just plug in the connector,

flick the switch, and carry the boxed speaker anywhere within the 15' to 25' range of the extension wire. The solid lines in the diagram show what must be done if the radio has a single output tube, for push-pull output make the changes shown by the broken lines as well. With single-tube output you'll need only a SPDT switch. A two- or three-way polarized plug and socket and two- or three-conductor wire make the connection.

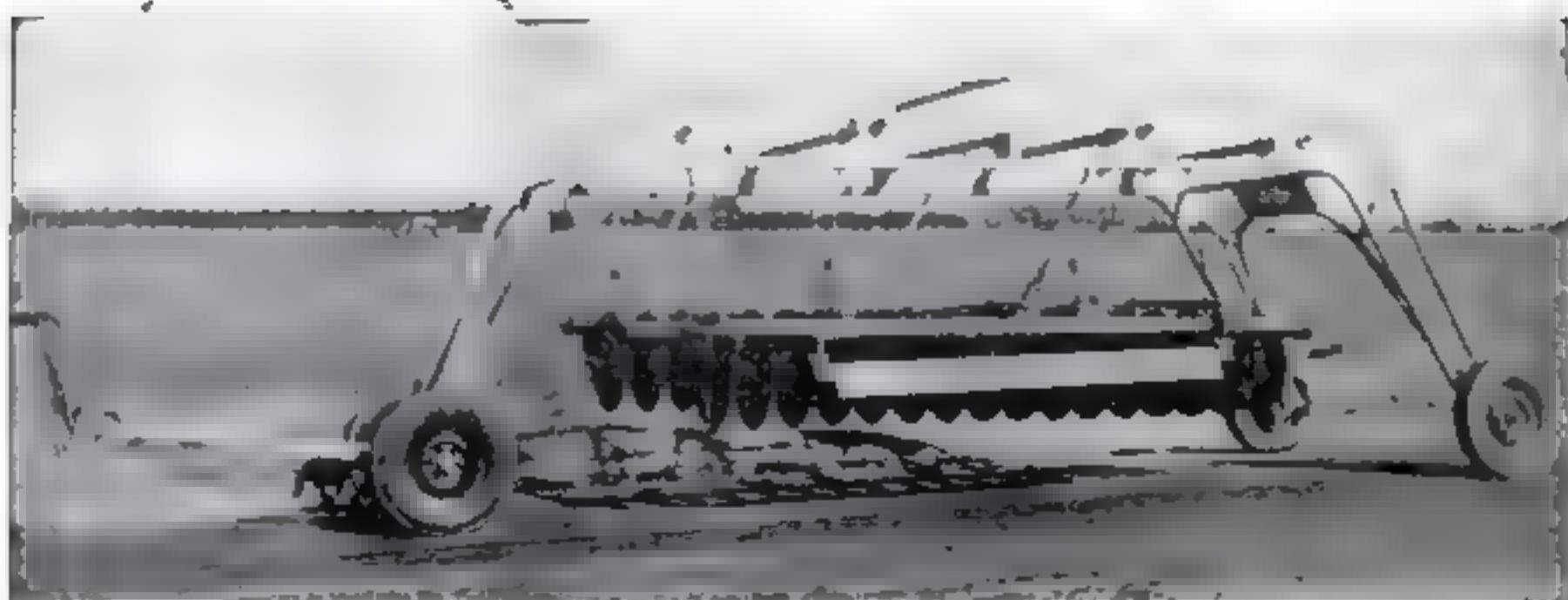
5158

New Antennas Chase "Ghosts"

TELEVISION and FM frequencies, with their interference problems from terrain or buildings, are bringing a crop of new antennas. A roof antenna for automobile communication systems, made by L. S. Brach Mfg. Corp., Newark, is shown in Fig. 1. It covers the 152 to 162 mc. band. Blanket coverage from 44 to 216 mc.—including old and new FM and all television channels—is claimed by Interstate Mfg. Corp., also of Newark, who make the receptor pictured in Fig. 2. The indoor television antenna (Fig. 3) can be shifted and tuned for clearest reception. Burnett Service Co., New York, sells the unit. The S-shaped, folded dipole (Fig. 4) is nondirectional and serves both FM and television. Technical Appliance Corp., Sherborne, N. Y., is the maker. It also makes the mast, Fig. 5, with separate orientation for high and low-band TV.



5318

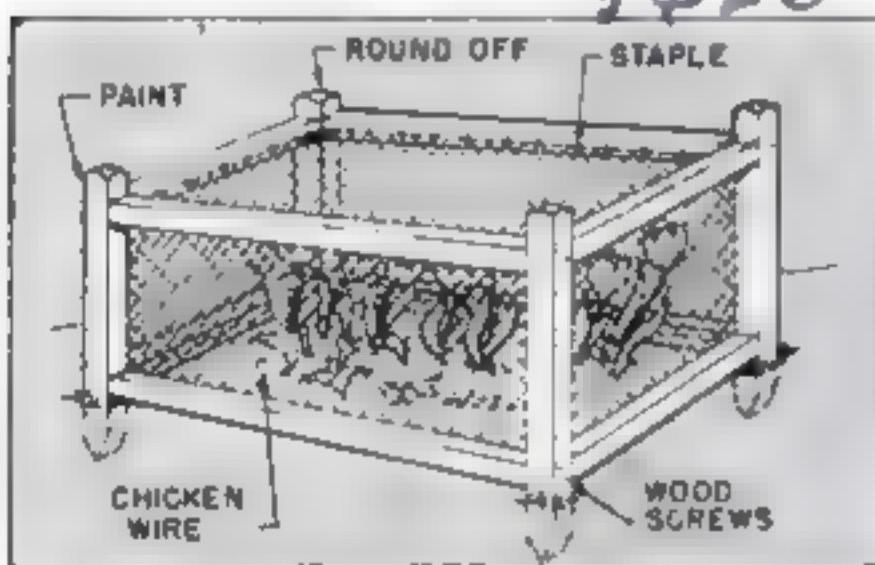


Implement Carrier Is Built Like Truss Bridge

LOOKING like a single-span truss bridge, this carrier transports heavy farm implements across fields and over highways. Four ratchet spools permit one man to lift a two-ton load into riding position. Chains carry-

ing the load are wound over the spools. The unit, built by the Marvin Lundplane Company, of Woodland, Calif., is all-welded, weighs 1,400 lb., and rolls on 6.50 by 16 four-ply tires as a trailer.

3426



Wire Frames Protect Flowers

SIMPLE guards to protect flowers and young shrubs may be made from small pieces of lumber and chicken wire. Staple the wire inside the frame and set the legs a few inches in the ground. Paint the frames white.—*Bernard Matzen, Napa, Calif.*

5733



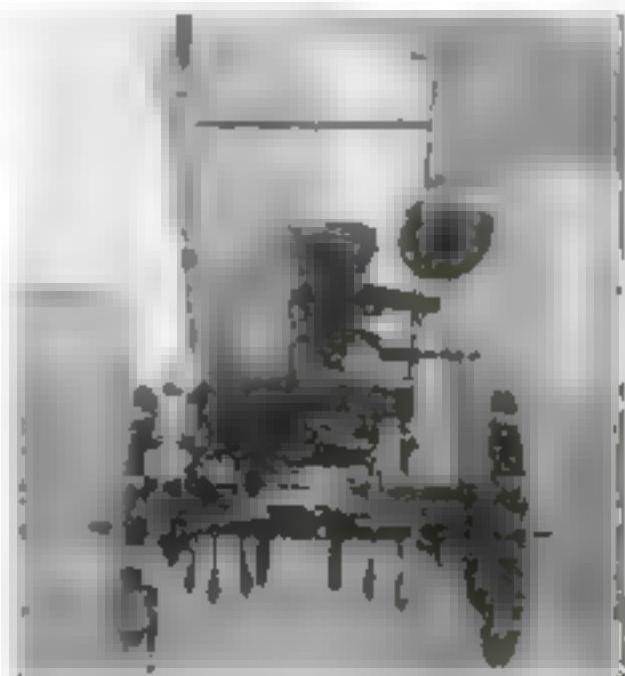
Rake Used with Light Tractor

THIS wheel-less, 390-lb. dump rake has 28 spring-steel teeth that provide a spread of 10'. The implement, designed for use with light tractors equipped with a hydraulic lift and a three-point hookup, is made by the General Corporation, of Dallas, Tex.

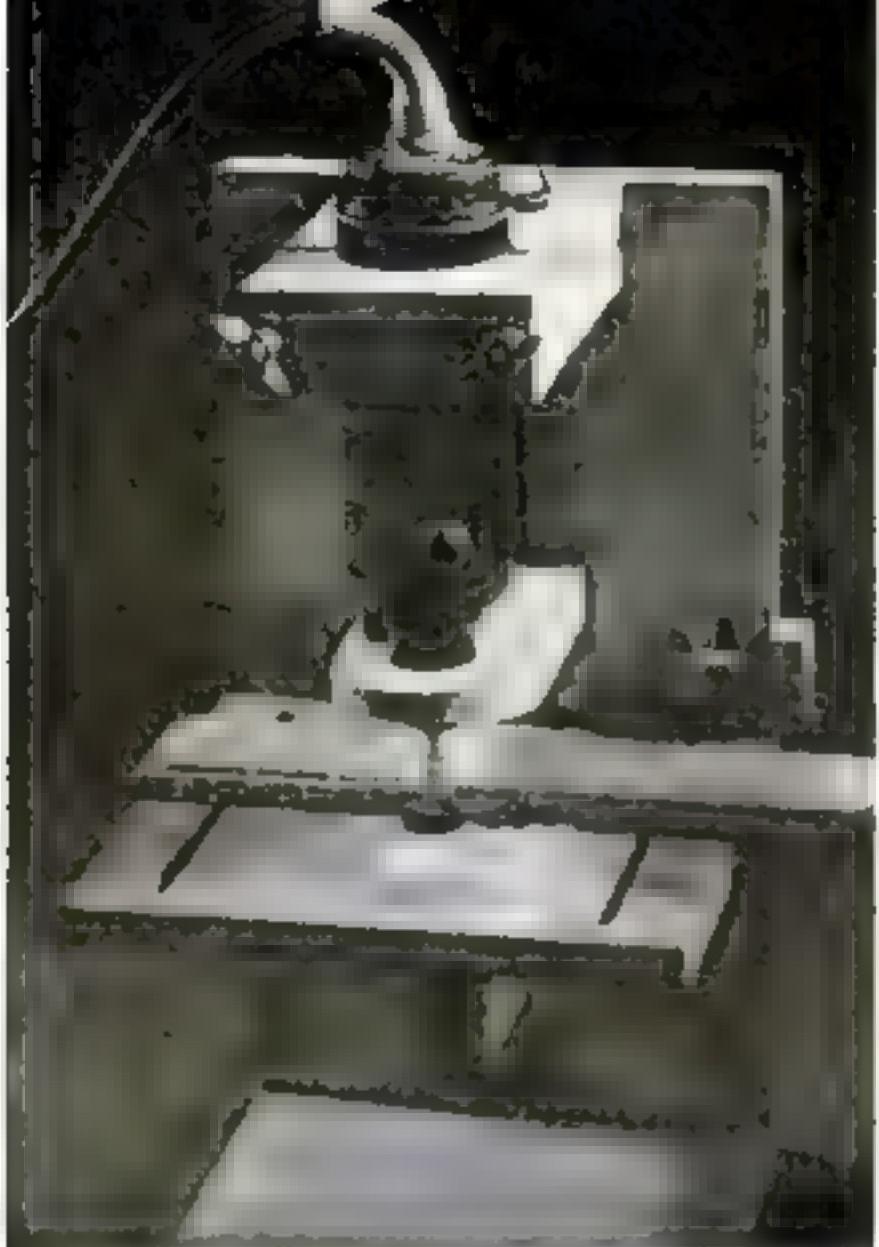
Cultivator Uses 3/4-hp. Engine

THIS small garden cultivator was built in about 15 hours, using scrap-iron parts and welded construction. The distance between the wheels may be varied from 12" to 20", enabling me to run it either between rows or to straddle rows.

For power, I've found a $\frac{3}{4}$ -hp. washing-machine engine satisfactory, though 1 $\frac{1}{2}$ hp. might be even better. The clearance beneath the axle is 12 $\frac{1}{2}$ ". The belt ratio is 1 to 12 and the chain ratio is 1 to 7. A movable idler pulley, controlled from the right handle bar, acts as a clutch. The draw bar may be raised or lowered from a height of 6" to 3".—*L. F. Van Der Volgen, Delphi, Ind.*



5099



A rabbet is cut by feeding the work across the table. For such operations, the side fence is down out of the way. When drilling, press the table and work slowly up against the drill.



For clamping the fixture to the workbench, a rigid base like this may be added. Otherwise, just clamp the upright in a vise. Make the table of plywood, the other parts of hardwood.

Dremel If a 60 Penny Wire Hand Grinder Is a

HELD in your hand, a small motor tool is often tough to manage. It takes real practice to make controlled freehand cuts; and the work almost never shows the line-splitting uniformity expected of power tools.

The fixture shown on these pages will put an end to that. It permits accurate work in drilling, rabbeting, routing, shaping, and planing small pieces of wood or plastic. With a couple of simple attachments, it will cut perfect rings and disks.

After completing the upright, shape the lower tool support. Drill the hole slightly undersize. Then sand it until the tool fits. For the top support, cut a hardwood block $1\frac{1}{8}$ " by 3" by $4\frac{1}{8}$ ". Drill it lengthwise for two $\frac{1}{8}$ " carriage bolts 5" long, countersinking the heads. Then saw the block apart $1\frac{1}{8}$ " from the other end and rough out a semi-circle in each cut edge with a jigsaw. Sand until the tool is a snug fit. Cement felt in the outer jaw.

For accurate work, the grinder must be supported with its centerline parallel to the backboard. To check this, attach the two supports, using wood screws at least 2" long. Then put the backboard flat on the work-bench and rest the grinder in the supports. Saw off or shim up the inner end of the top support as required to bring the tool to a parallel position.

Wood screws hold the slotted side fence to the table. With a screwdriver, you can then raise or lower the fence as desired.

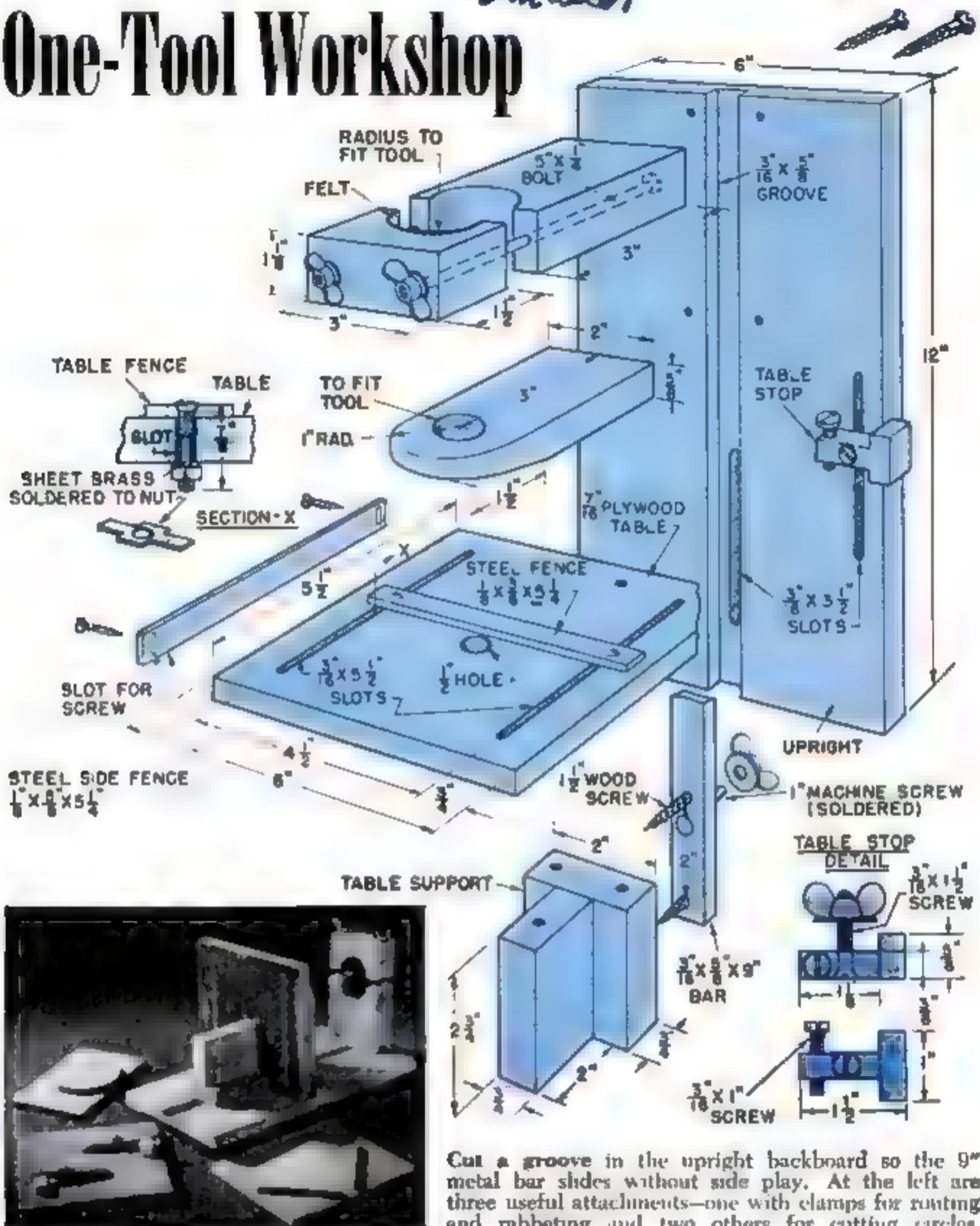
Adjustment of the other fence is made from above, likewise with a screwdriver. Cut two pieces of sheet brass to the shape shown in the drawing. Bend up the long projections and solder one piece to each nut. These keep the nuts from turning.

Drill screw holes in the T-shaped table stop slightly undersize. This will keep the horizontal screw from turning with the wing nut. Lubricate the other so that it can be turned easily with a screwdriver when fine depth adjustments are desired.

When you're ready to operate, raise and clamp the table so the tool just touches the work. Also bring down and clamp the table stop with the screw touching the table. After taking a fine cut, back off the table stop and raise the table again. In this way, make a succession of cuts until the desired depth is

Chicago Wheel & Mfg. Co. grinder is slightly smaller

One-Tool Workshop



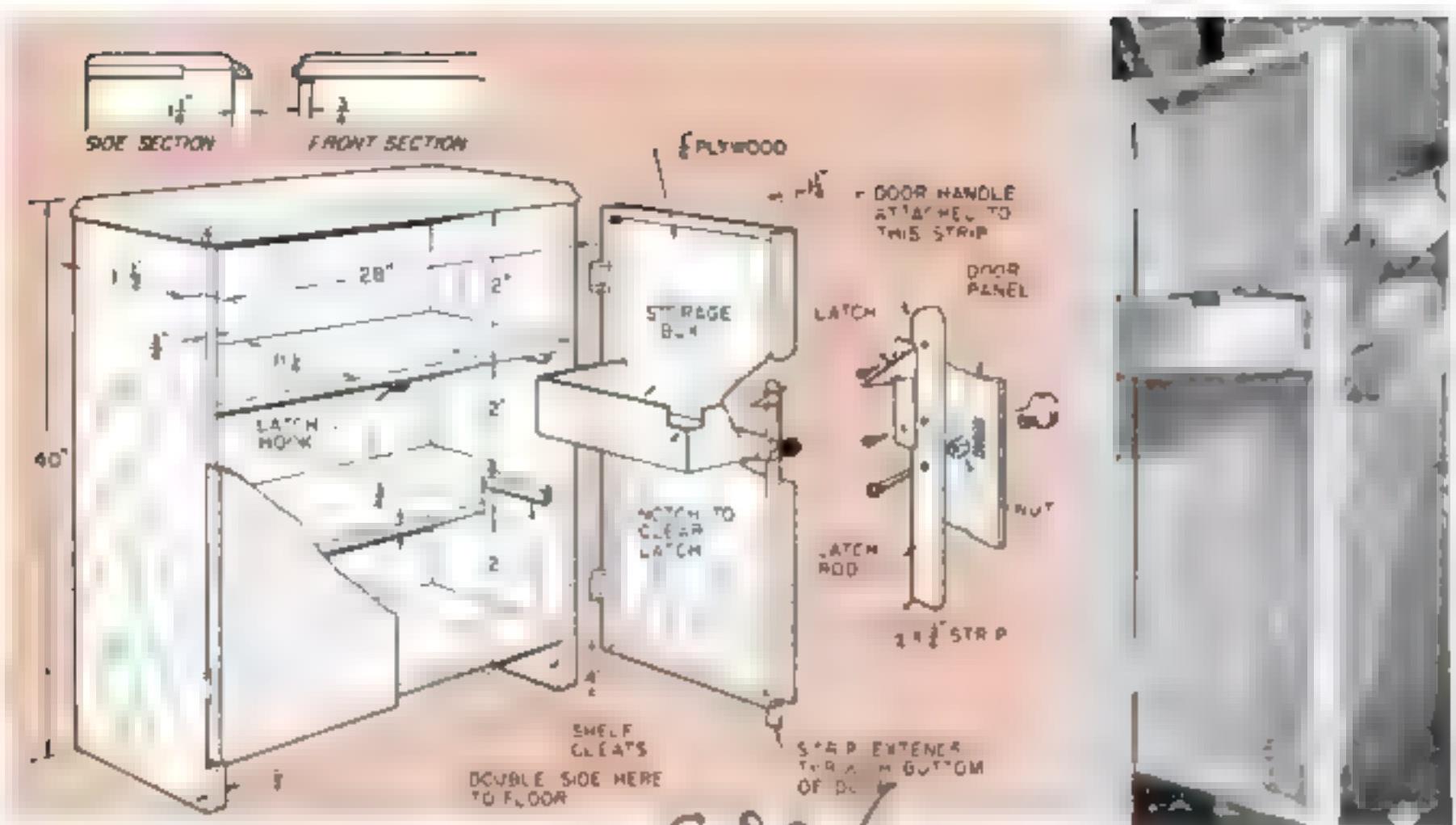
Cut a groove in the upright backboard so the 9" metal bar slides without side play. At the left are three useful attachments—one with clamps for routing and rabbeting and two others for cutting circles.

reached. The same depth can be duplicated in other work by leaving the table stop at its final setting.

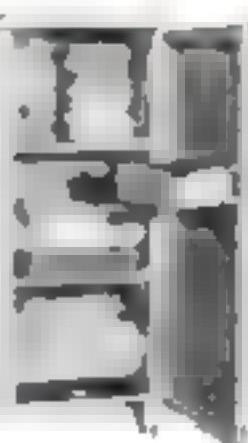
Special fixtures will increase the versatility of the device. A piece of $\frac{1}{8}$ " plywood about $3\frac{1}{2}$ " by 6" may be fitted with a pivot (say, a wood screw with the head filed off) on which turns a 3" plywood disk. Three phonograph needles protrude from the disk just enough to hold any workpiece pressed

on it. This can be used to cut accurate circles with square or shaped edges.

Another plywood panel with two metal fences at 90 deg. will permit concentric cuts on work already round. Still a third fixture can be used as a supplementary rabbeting attachment. This is a plywood rectangle fitted with a fence and miniature hold-down clamps. With work in place, it slides on the main table.—J. A. Appelquist, Leonia, N. J.



Two-Way Latch Opens Linen Chest

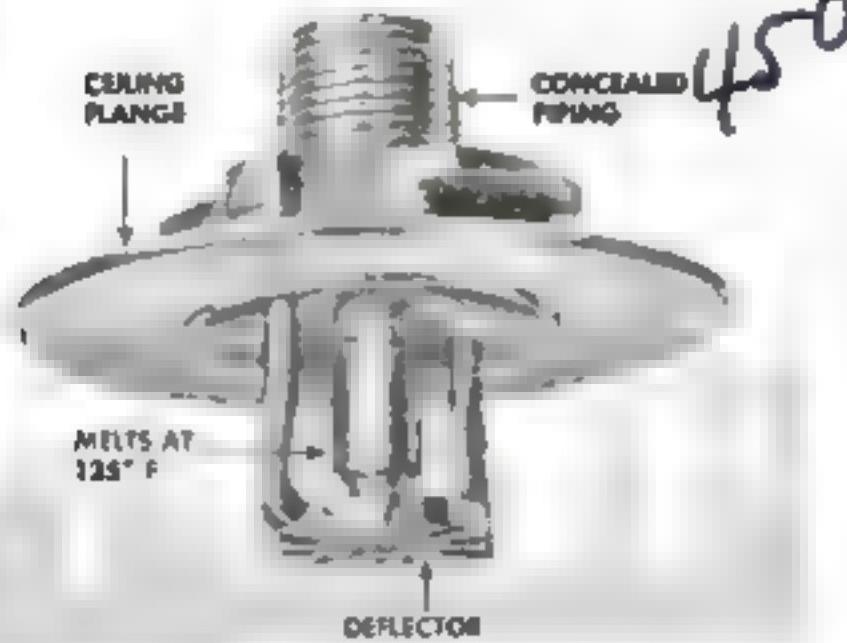


This roomy linen cabinet has two unusual features: a hand or foot-operated latch and a storage box built on the inside of one of the doors. The storage box is handy for miscellaneous small articles, whether you keep the cabinet in the bathroom or a bedroom, or even the kitchen. It's built on the door so that it occupies space ordinarily wasted at the top of a shelf. The advantages of being able to trip the latch and open the door with your foot are obvious, especially when you're groping for a towel with wet hands.

Simple construction with butt joints is used throughout. All screws are countersunk and heads covered with composition wood. The sketch gives you the dimensions and details you'll need.

Note that the sides are doubled below the bottom shelf. This supports the shelf and gives the legs a more substantial look.

The door latch is extremely simple, being just a strip of plywood sliding in notches cut in the door frame. The catch is cut from a metal corner bracket that can be bought in most dime stores. Both the hand knob and catch are screwed to the strip of plywood, which extends down through the bottom of the door frame. Sand the cabinet well and finish with paint, enamel, or stain.—Robert Hoppough, Waukegan, Ill.



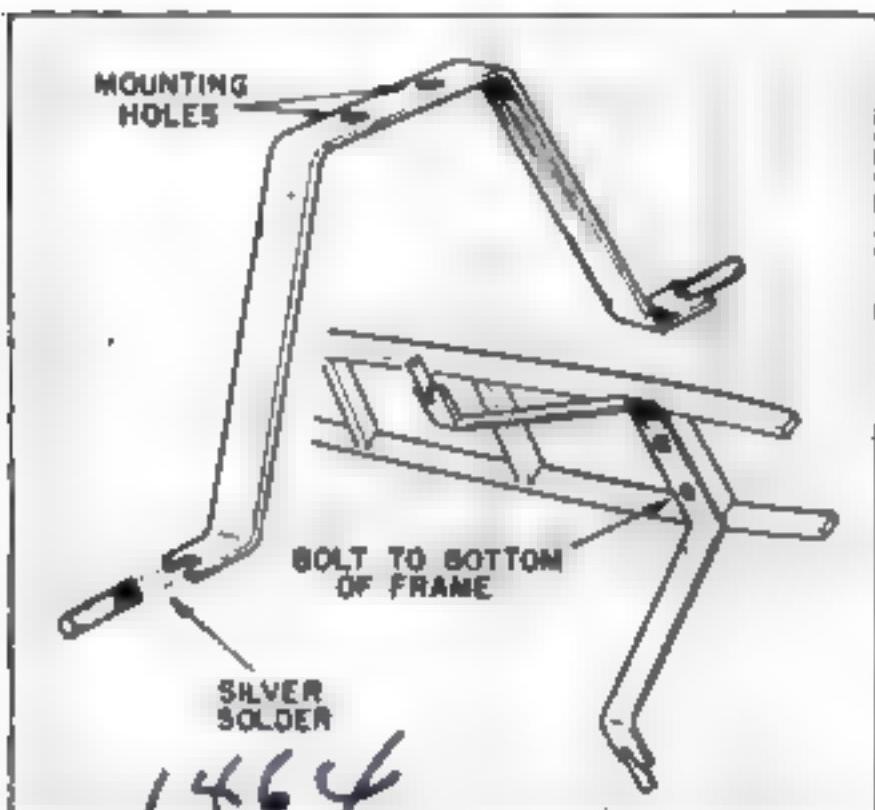
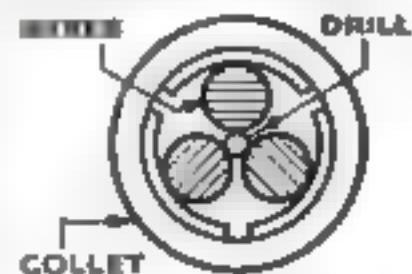
Sprinkler Has Hidden Pipes

A fusible sprinkler, with pipes concealed in the ceiling, has been introduced by the Grinnell Company, Inc., of Providence, R. I. The automatic sprinkler was especially designed for rooms where the decorative effect would be spoiled by exposed pipes along the ceiling. Only the deflector, its supporting arms, and the narrow ring that covers the opening through the plaster show below the ceiling level. A temperature of 135 deg. F. will start the sprinkler. This is about 30 deg. lower than the rating of many sprinklers.

4003

Drill Held in Collet by Wires

I WANTED to drill some No. 80 holes but couldn't find a chuck that would close on such a small drill. Finally I inserted three pieces of wire in a $\frac{1}{8}$ " collet and put the drill in the center. By tightening the collet, the drill was held true. You can find the diameter of the wire you need by subtracting the drill radius from the collet radius.—*Robin Williams, Knoxville, Tenn.*



Landing Gear of Spring Steel

SPRING steel from an old phonograph motor or a hacksaw blade makes an ideal landing gear for a gas model plane. I find such a gear absorbs more punishment than the common piano-wire type. Soften the spring by heating, and then shape it. Restore the temper by heating and quenching in oil.—*Freddy Mitchell, Simsboro, La.*

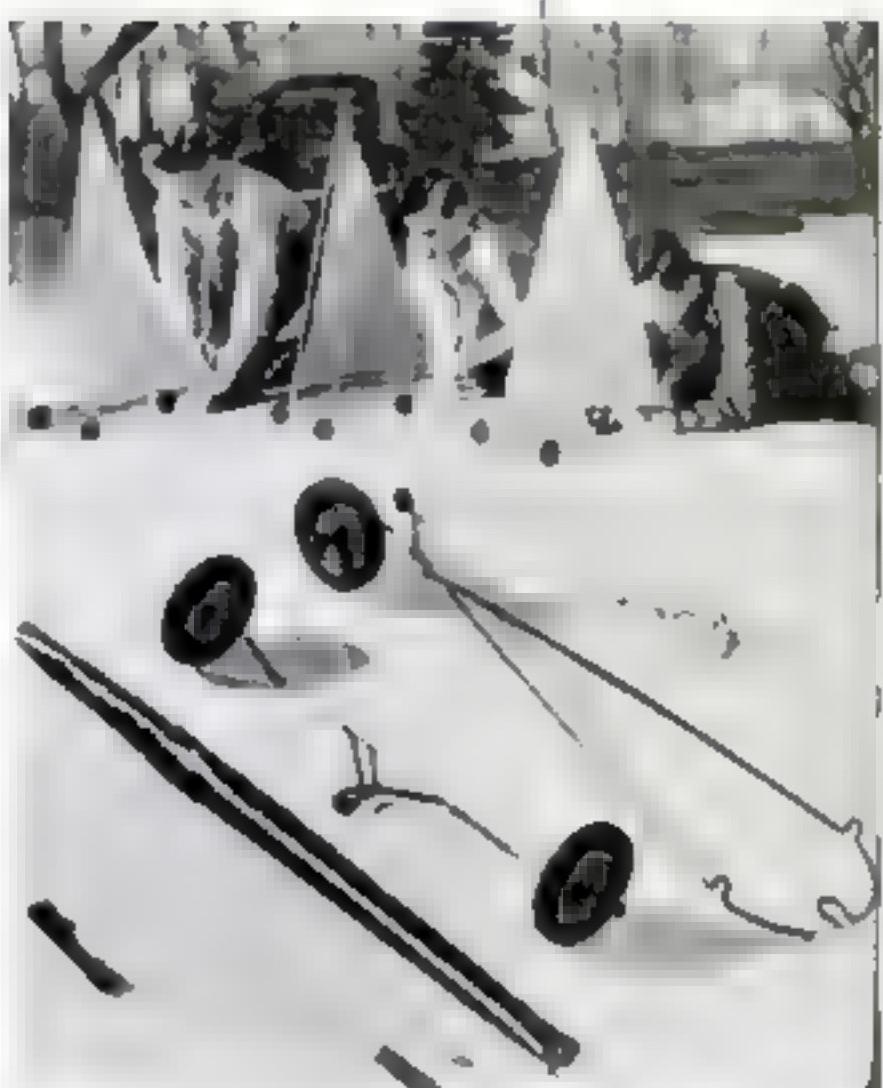
How to Shorten Tiny Screws

HERE's a neat way to cut off very small machine screws without damaging the thread or heads. Get a piece of scrap metal the same thickness as the desired screw length. Tap and countersink a hole to suit. Drive the screw in all the way, turn the piece over, and file off the projecting part of the shank. Removing the screw takes off any burrs.—*Herbert Pfister, Bronx, N. Y.*



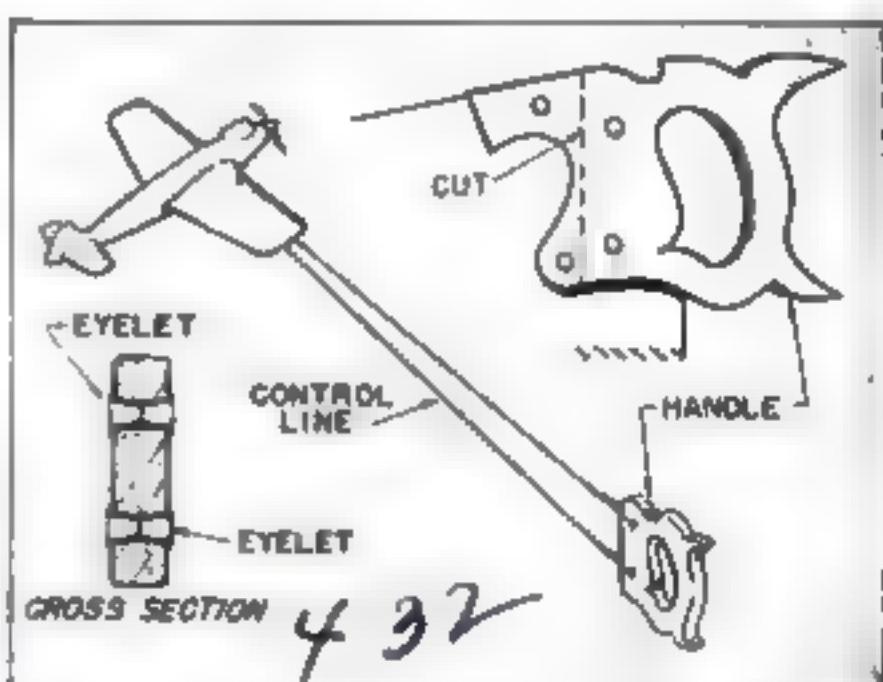
5359

52X5



Toy Copied from Sand Sailer

THESE miniature sailers, modeled after the sand sailers raced on southern beaches, are assembled from the kit shown. The toy, which is made principally of plastic, sports a gaily colored sail, smooth-rolling rubber wheels, and a patented non-tipping action. Sand Sailers, Inc., of New York City, is the manufacturer.



Plane Control From Saw Grip

A COMFORTABLE control handle for control-line models may be made from a discarded saw handle, or from a replacement handle. Cut off the grip as shown in the drawing. Use four eyelets to bush the holes in the grip and prevent the steel line from cutting into the wood.—*David L. Hyman, Brooklyn, N. Y.*

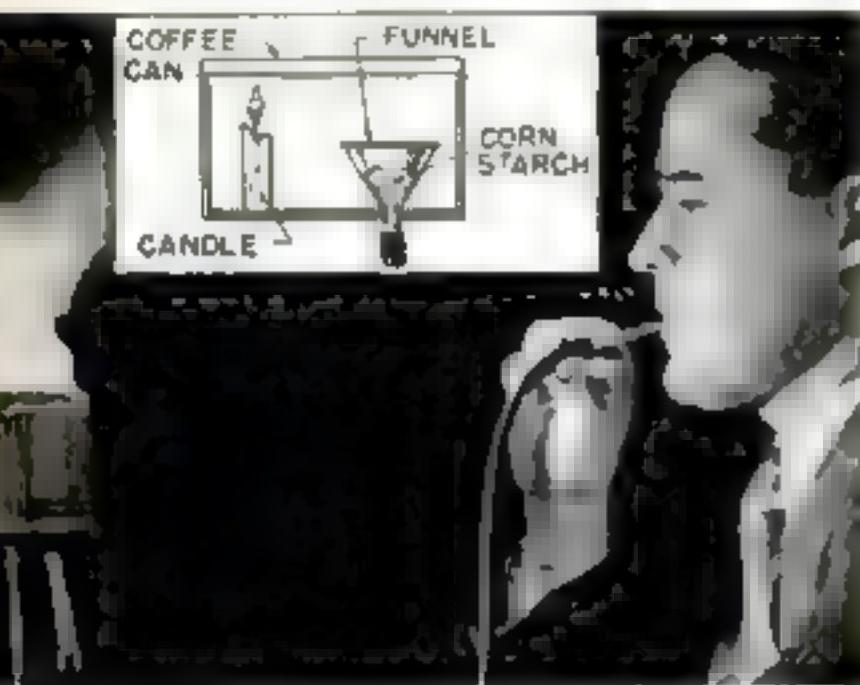
Tests Show Chemical Fire Hazards

ORDINARILY, an oxygen atmosphere is necessary to keep a fire going. But like most rules, this has its exceptions. When heated, some substances supply their own oxygen and burn without air.

Again, fire is usually thought of as being started by a spark or flame. But certain materials have such low kindling points that

just a little heat is sufficient to set them ablaze.

These and other tricks of fire are illustrated in the following experiments. In a chemistry laboratory, hazards of this nature constantly lie in wait for the unwary. So if your hobby is chemistry, better give thought to the possibility of unexpected fire.



Heated Rod Starts Fire. Carbon disulphide has such a low ignition point that a spark or flame isn't necessary to fire it. A heated glass stirring rod will do the trick when brought near enough.

For this experiment, pour a teaspoon of the liquid into a can cover placed on an asbestos mat. (Never handle carbon disulphide in the vicinity of an open flame.) Then heat the end of a glass rod in a candle or gas flame in another room and bring it near the liquid. If the rod is as hot as 250 deg. C., the carbon disulphide will quickly burst into flame.



Fine Particles Explode. Coal dust, sugar, and starch are seldom thought of as explosives. Yet if divided finely and mixed thoroughly with air, they burn almost as readily as a gas. A dust explosion results.

You can create a harmless dust explosion with the setup at left. Warm the cornstarch a few minutes to dry it. Then put about a half teaspoon in the funnel. The coffee can must have a friction top, not one that locks in place by twisting. Set a lighted candle beside the funnel, put on the top, get your distance, and blow sharply through the tubing. Don't delay or the candle will go out.

Flame Separates from Candle. Although we don't usually consider it as such, a candle flame is actually a gas flame. Once a candle is lit, combustion heat liquifies and then vaporizes a little of the wax.

To prove that it's gas, we can cause the flame to burn for a few seconds when detached from the wick. Put a teaspoon of baking soda in a quart jar and add vinegar until the bubbling stops. This generates carbon dioxide gas. Attach a burning candle to a wire as shown and lower it gently into the jar. If carefully done, this will cause the flame to leave the wick.





Fire Starts Spontaneously. Phosphorus has such a low ignition point that it burns spontaneously at room temperature. Hence, it must always be stored and cut under water, handled with tongs, and never allowed to touch your skin or clothing.

With tongs, drop a pea-sized piece into

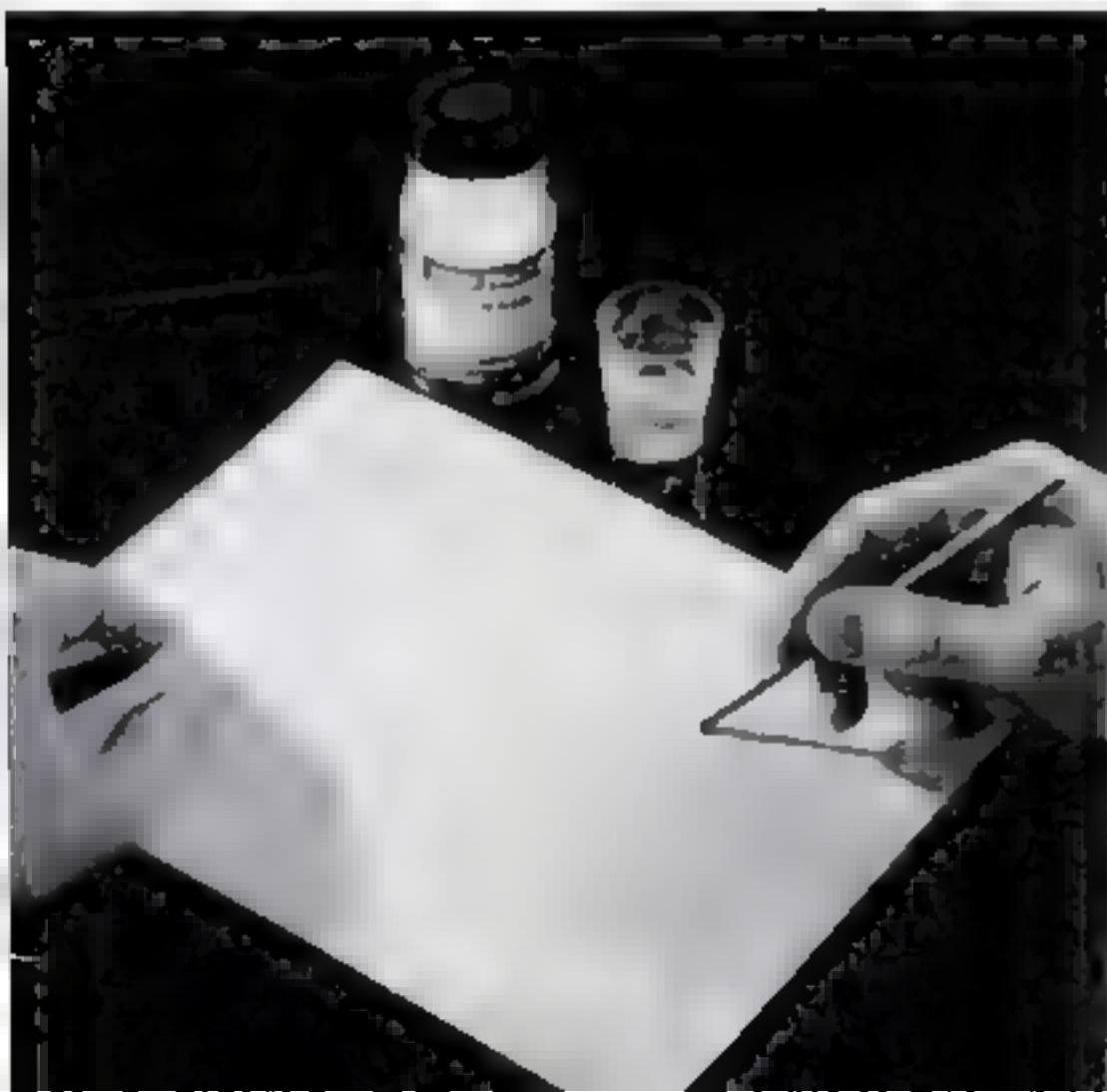


a metal bottle cap floating in lukewarm water. It will catch fire immediately. Cover as shown. Water will rise in the tumbler as the phosphorus unites with oxygen in the air. The white smoke is phosphorus pentoxide, a fine powder. Dissolving in the water, it forms weak phosphoric acid.

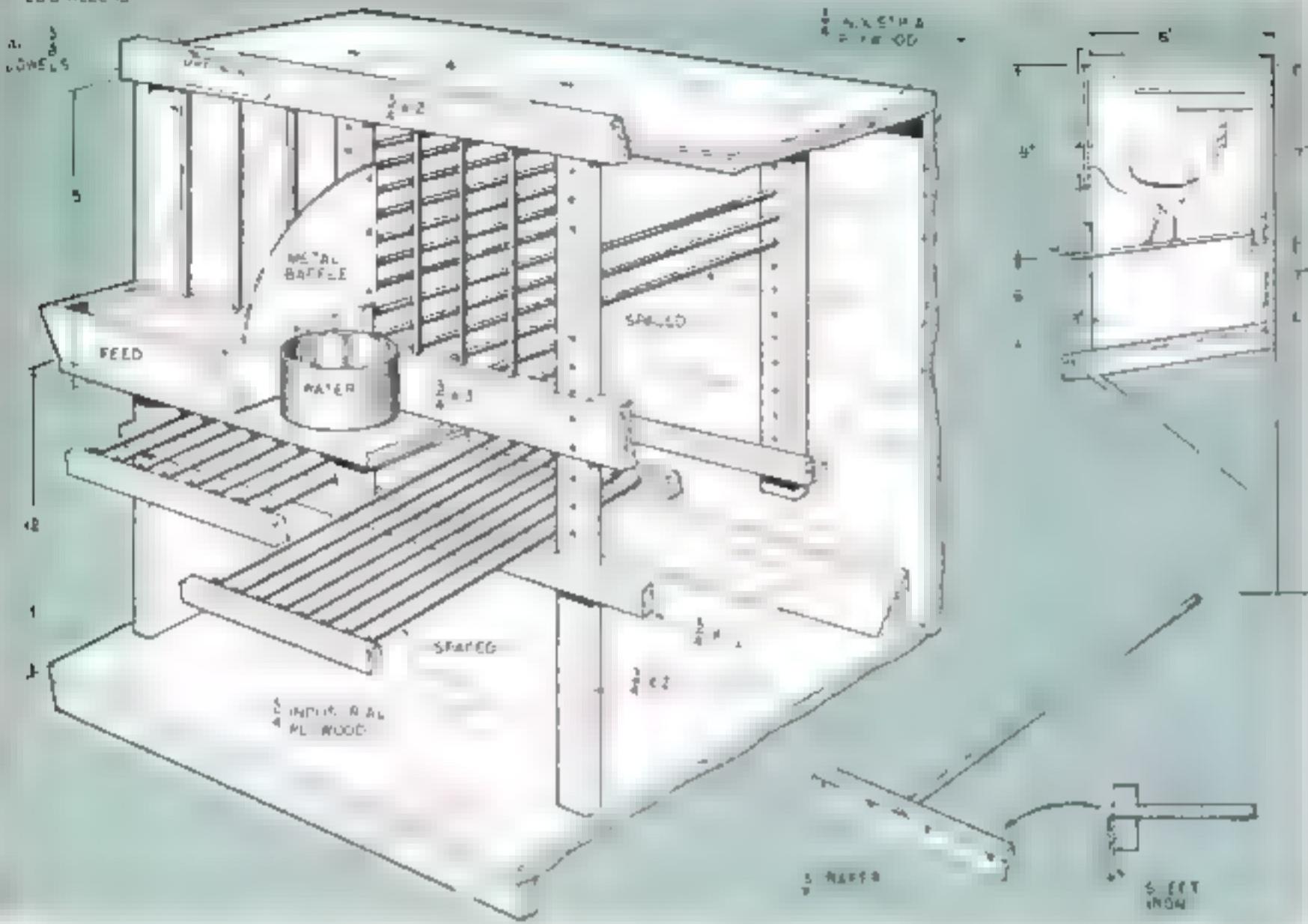
Air Isn't Always Needed. Chlorates and nitrates are examples of materials that burn without air. When heated, they supply their own oxygen. Substances of this type are used in explosives, and for safety, you'd better leave them alone.

However, you can have some fun with a little potassium nitrate. You've probably

seen "tracing sheets" to which you apply a lighted cigarette and then clear off your "horse" as it burns and spatters to the finish line. To make such sheets, dissolve all the potassium nitrate you can in a teaspoon of warm water. Then use this as ink to draw invisible irregular lines on uncoated paper. Let dry before using.



EGG RECORD



Raise Your Own Eggs on a Shelf

You can raise more than enough eggs for a family of four with this hen house that fits in even the smallest of backyards. That is, if the local ordinances in your neighbor-

hood or town permit keeping chickens.

Although the house is only 7' long and 18" wide, it accommodates six hens the year round. My original flock of White Leghorns, shown in the photo, lay more eggs than we can use. The house stands beside the garage during the summer and is moved under cover during the winter months.

The hens stand on a removable, sloping grill. When an egg is laid, it rolls down and out the front. The chickens may be removed by sliding out the grills. However, as long as the hens are fed and watered they do not need exercise for high egg production. Mine never leave the compartments.

—Hi Sibley, Nuevo, Calif



Pipe-Insulation Straps Cut from Metal

While covering pipe with insulation, I ran out of the conventional bands. I made some straps from thin sheet brass which held just as tightly as the conventional type. Cut strips $\frac{1}{8}$ " by $9\frac{1}{2}$ ". Then slit one end about 1" as shown at the left of the photo. Next bend the tabs back to make a 90-deg. angle with the strip. Bend the tabs up and over. Push the other end under the tabs, and bend the end back.—George Gluck, Sheboygan, Wis.



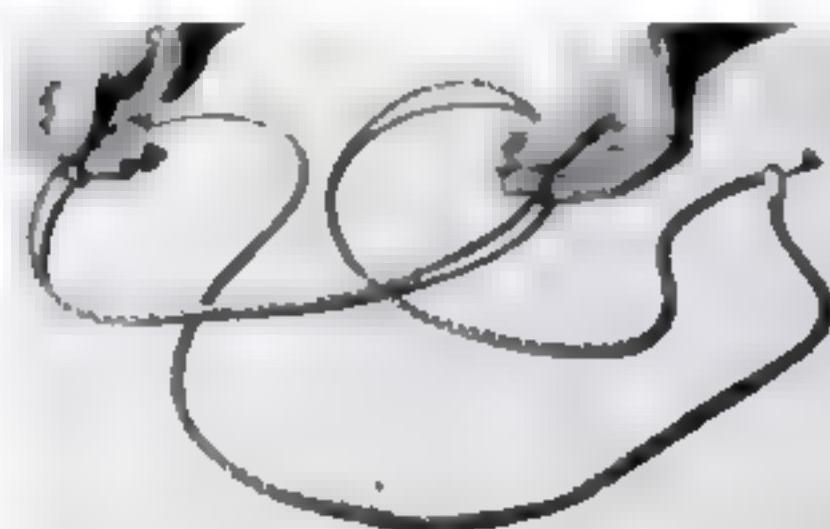
594 / Jug Hitch Lugs Jug



This hitch is useful in carrying heavy objects such as carboys, auto batteries, and other containers that have projecting rims but no handles.

If you use a piece of rope such as that shown in the photographs, you'll have to tie the two ends together to form one of the handles. Of course you can splice a rope to form a circle before tying the hitch.

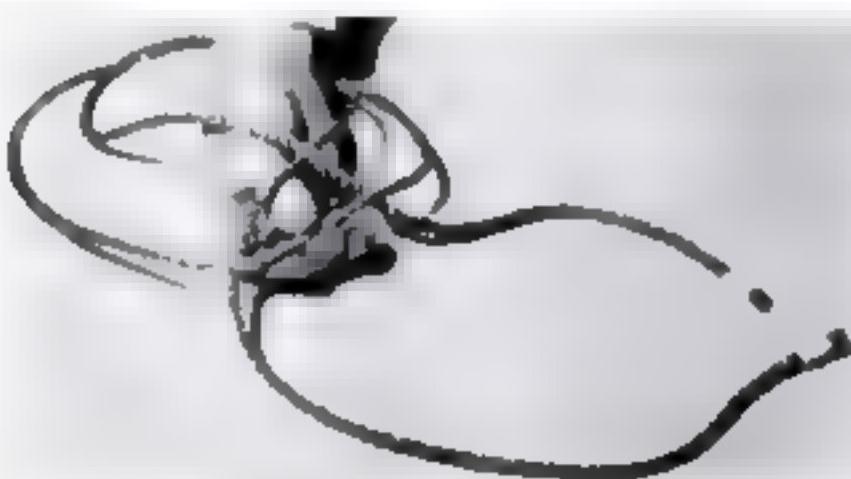
When you have about completed the knot, as shown in the fourth photo, turn it over and drop the opening of the two concentric loops—not the single loop at the left—over the neck of the jug.—John P. Arnold, Doylestown, Pa.



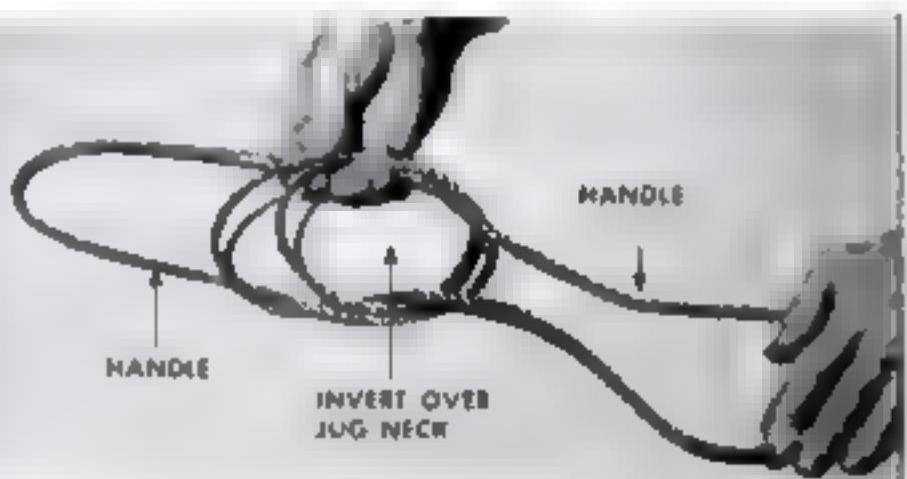
1. To start a jug hitch, use a short piece of rope, forming two loops as shown in this photo.



2. Place a portion of one loop over the other. You can place either of the two loops on top.



3. Now put your hand through the center of the crossed loops and grasp center of the rope.



4. Finally, pull this back through the crossed loops and turn knot over onto neck of the jug.

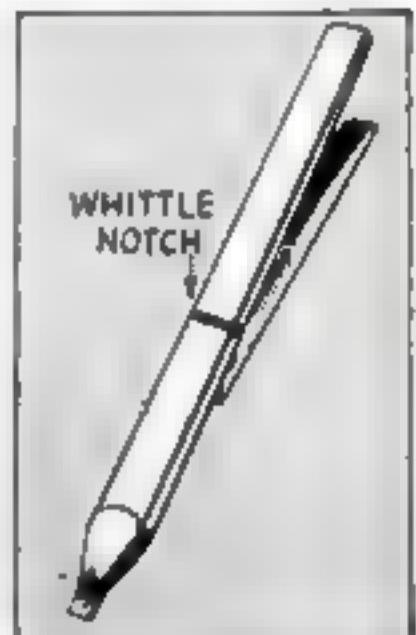


Handle-Bar Grips Help Tools

GARDEN tools fitted with rubber grips, as shown in the drawing, are easier to use and easier on your hands. Make the grips by cutting the ends from standard bicycle or motorcycle handle-bar grips. Cement them in place.—Don G. Pittwood, Moscow, Id.

Clothespin Holds Flat Penell

A SURE-GRIP clip for a flat carpenter's pencil can be made from a spring-type clothespin. Remove half the clothespin and slip the pencil in its place. To make sure the pencil won't slip, cut a notch for the wire as shown in the sketch.—Munro Hill, Elbridge, N. Y.



4380

5256

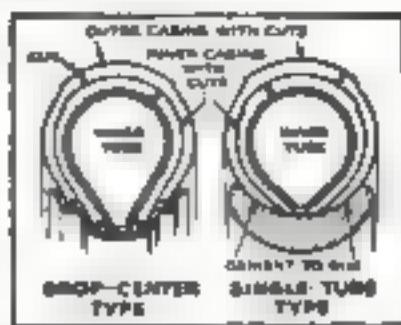


Airplane Dope Used as Dye

WHEN diluted with its thinner, model-airplane dope can be used as the coloring solution for internally carved plastics. Dope is cheaper and easier to obtain than the usual dyes made for the purpose. The colors "take" readily, are richer and more opaque. Another advantage of dope over dye is that the rate of flow may be controlled somewhat by the degree of dilution. Also there is a more even coloring, whereas dyes are absorbed more by rough spots and chips than by smooth plastic.—G. Walton, Cincinnati.

Double Life of Bicycle Tires

Two bicycle tires that have been badly cut can be combined one inside the other to get nearly the full amount of wear from them. One entire tire



is used as a liner for the other, as in the above diagram. Place the casings so the cuts on the inner tire are protected by undamaged sections of the outer tire, while cuts on the inner one are protected by good parts of the outer tire.

After the outer tire is worn, reverse the casings. I was surprised at the service I got from two tires that were marred by small but unreparable cuts. If you have difficulty slipping the double tire over the rim, try a liberal amount of watered soap as a lubricant. If you use this system on a single-tube type tire, do a thorough cementing job.—H. E. Massa, Greenwich, Ohio.



Headlines Clipped for Boat Lettering

LITERALLY, my boat is a headliner. While I'm not an expert sign painter, I came up with a very professional looking job of lettering across my craft's stern. All you do is watch the large, page-one headlines in your daily paper, and clip out the necessary letters to spell out the name you want. Then apply a coat of clear spar varnish where the letters are to be placed. While the varnish is still wet, press the letters firmly in place. Follow with another coat of varnish and let it dry.—Charles Farnsworth, Damariscotta, Me

LAYING PARQUETRY FLOORS [WOODWORKING]

Good subflooring, surfaced level and with large cracks filled, is required as a backing for a parquetry floor. The hardwood blocks may be 1" to 1" thick. They may be obtained made up at the mill in assembled squares or in block sets of pieces cut to size and tongue-and-grooved on ends and sides. Or the squares can be made up on the job and the pieces laid with plain butt joints.

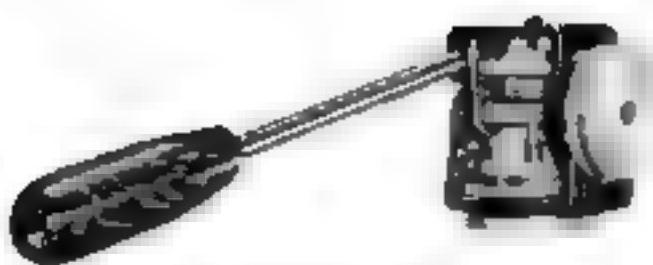
A practical method of laying plain-edged $\frac{3}{4}$ " parquetry is to set the pieces in hot glue, toenailing through the edges of the larger. If there is a border, lay it first, then begin in one corner, assembling a square and work around the edges, square by square, toward the center. Straight lines will depend on accurate sizing of the blocks. Running " or a tendency of the squares to vary in size, also may be caused by failure to drive corresponding pieces together with the same force. Corrections can be made by dressing the ends and sides of pieces in the larger squares.

Thick casein glue may be substituted satisfactorily for hot glue, but the latter has the advantage of beginning to hold as soon as it chills.

Thin parquetry is best made up in squares on the bench. Cut the pieces accurately to size, groove all sides and ends, and glue in thin hardwood slip tongues cut with the grain running crosswise. Glue tough-paper or thin canvas backing on the assembled squares, and then glue them to the subfloor. Brads may be used around the edges for blind nailing. Often small finishing nails are driven through the faces, set $1/16$ ", and puttied to match the finish.

Have on hand a pan of warm water and a cloth to wipe off any squeezed-out glue. Sanding must be done with care because of the changing grain direction. Some final hand sanding with the grain is advisable.

POPULAR SCIENCE MONTHLY SHOP DATA



KODAK TURN-TILT TRIPOD HEAD—permits fast aiming with still and movie cameras. Has multiple-disk felt friction clutches for smooth, easy panning.



KODAK EYE-LEVEL TRIPOD (right) sturdily built to last for years . . . designed for fast set-up. Adjusts from 2 to 5 feet in height. A simple twist locks legs at any extension. Weighs only 2 pounds—folded, it measures 22½ inches. Sper points of the legs give firm surface grip—removable rubber tips included for indoor work.



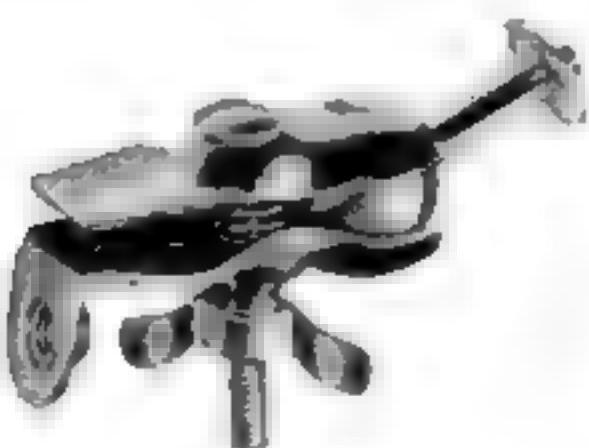
KODAK TABLE TOP TRIPOD—makes table-top photography real fun. Elevates camera to convenient level. 8½-inch rubber-tipped legs are detachable for compact carrying.



KODAK METAL CABLE RELEASES—eliminate danger of jarring camera when tripping shutter. 7-inch and 12-inch sizes to fit practically any camera.

STEADY DOES IT

For "on-the-button" shots it's a **KODAK TRIPOD OR OTHER KODAK CAMERA SUPPORT**. Try one for easy control of your camera—for all-round better pictures. See them all at your Kodak dealer's.



KODAPOD—substitutes for tripod out-of-doors. Toothed jaws bite into tree, fence, or any other wooden support. The tilt is controlled by thumb screw.

KODAK OPTIPOD (left)—its handy felt-lined clamp grips shelf, table, window ledge. Ball-and-socket head holds camera in any desired position.



KODAK TILT-A-POD—on your tripod it permits tilting either movie or still camera. Quick-locking screw prevents slipping after adjustment.

EASTMAN KODAK CO.
ROCHESTER 4, N.Y.

"Kodak" is a trade-mark

Kodak



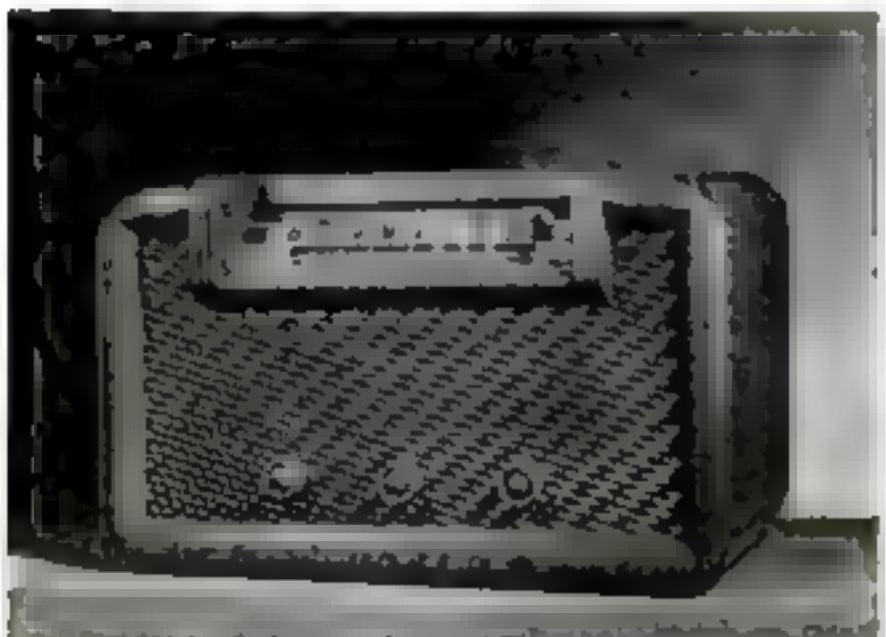
Louvers "Light" Room

You can hide unsightly pipes and wiring with a louver-design, false ceiling that can be installed below fluorescent lights. Consisting of transparent plastic louver sections, channels, and fittings, the sections transmit 71 percent of the light, provide uniform illumination. The Benjamin Electric Manufacturing Company, of Des Plaines, Ill., is the manufacturer of the ceiling, which is given the name of Sky-Glo® Light.



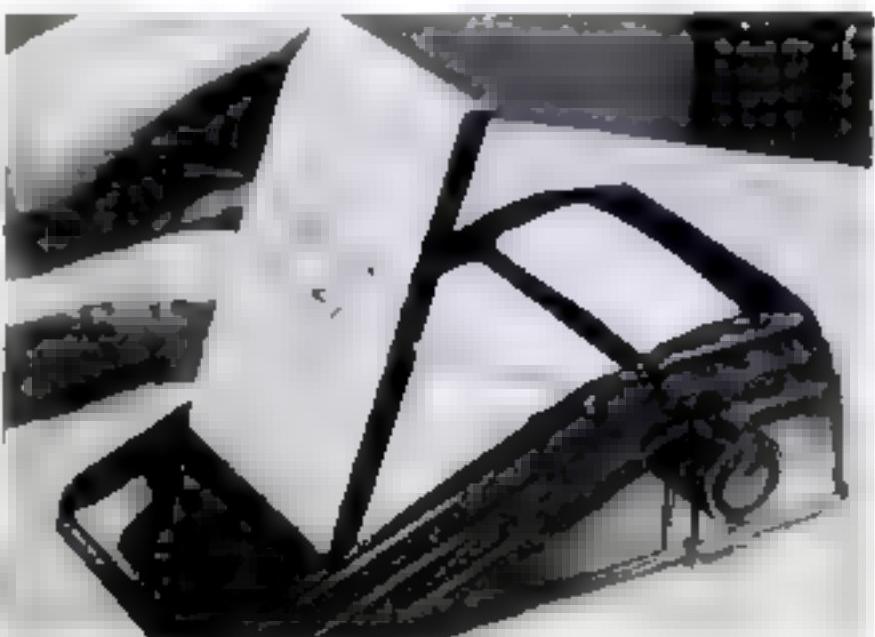
Improved Camera Lens

THE Cine-Ektar® 25-mm. lens opens new possibilities of high speed work to the average 16-mm. amateur movie maker. Opening to f/1.4, the Cine-Ektar® is said to offer finer definition and resolution than has yet been possible at such a wide opening. Use of rare-element glasses and ultra-hard lens coatings, according to Eastman Kodak, permits this. Objects only 9½ inches away can be brought to sharp focus.



Better Metal Sheeting

WITH a process called Rigidizing®, thin metal sheeting emerges not only stronger but handsomer. By redistributing the metal in a sheet, the process increases stiffness and at the same time impresses a design. Patented by Rigid-Tex Corp., of Buffalo, N. Y., the process makes steel stiffer by 88 percent, and aluminum, by 108 percent. The radio above has a rigidized grille.



Pad "Files" Notes

JOT down a note on this desk pad--and it's permanently filed. The knob at the side of the case turns a roller, which feeds paper over the pad and up and around a plate that fits into the writing bed. To get a clean writing surface, the plate is flipped over. A previous notation can be rolled back in sight. The pad is a product of Permanote, Inc., of Philadelphia, Pa.

The '49 Ford

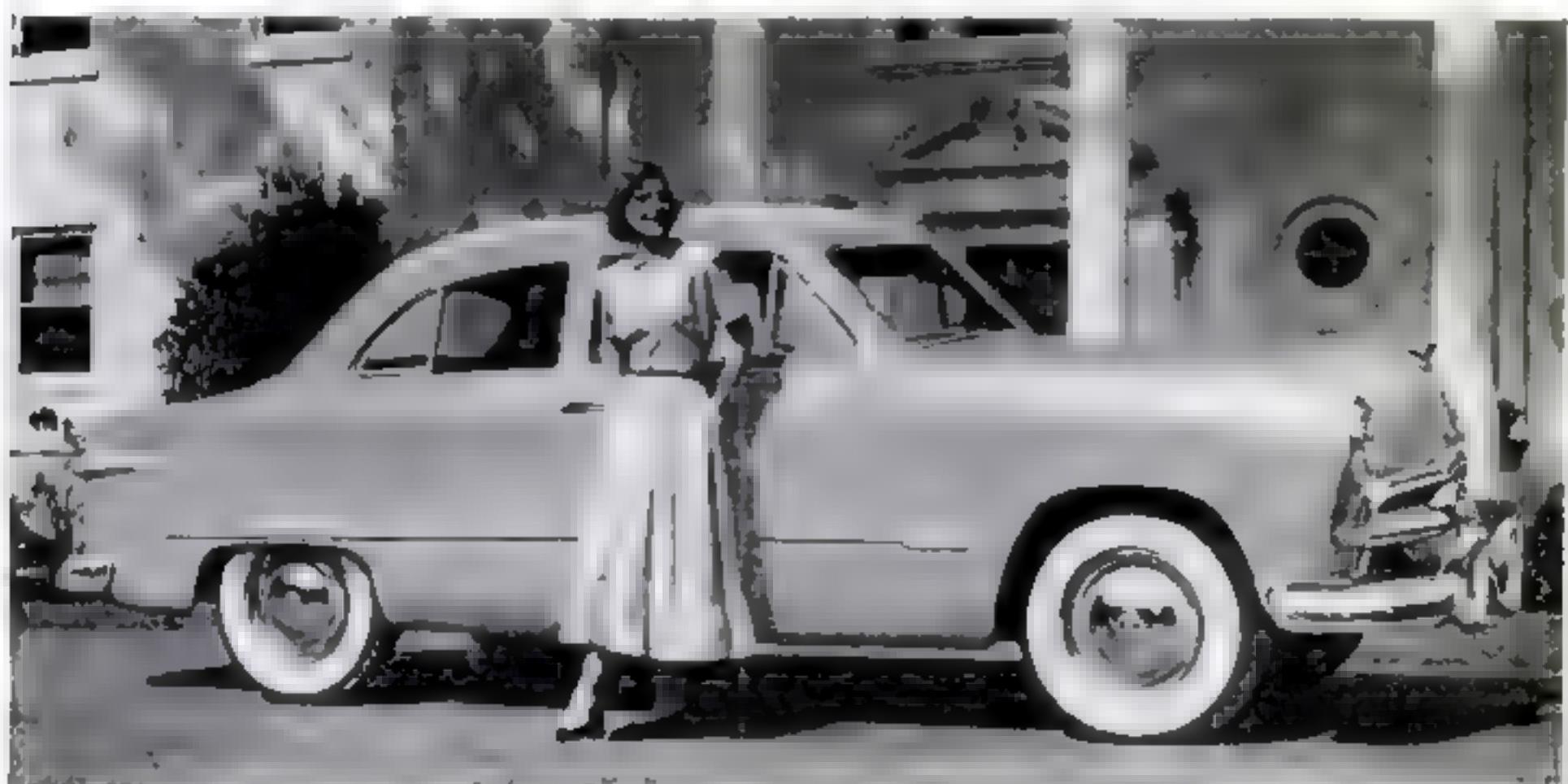
"THE CAR OF THE YEAR"

Designed to set entirely new standards of comfort, performance, economy and beauty in its field, the '49 Ford represents a complete break with the past. Here is a car that is completely new, inside and out. A car that is the triumphant result of thousands upon thousands of man-hours spent in research, design and testing . . . of millions of dollars invested in new facilities, machines and equipment to do the job. From the clean, low lines of its fresh styling to the smallest detail, inside and out, the '49 Ford is truly "the car of the year!"

High on the list of important changes is new riding comfort with new independent front wheel suspension, parallel rear springs and

Hotchkiss drive. Of equal importance to many are the new engines—100-hp. V-8 and 95-hp. Six, which offer greater economy, improved service accessibility and other features which will mean smoother operation and longer engine life.

The complete line of '49 Fords includes two series: the Custom and the Ford. There are five body styles in the Custom Series—Tudor Sedan, Fordor Sedan, Club Coupe, Convertible Club Coupe, and Station Wagon. In the Ford Series are four models—Tudor Sedan, Fordor Sedan, Club Coupe and Business Coupe. A range of ten body colors is also offered, although all colors will not be available on all models.



Body Styling. Regardless of body style or series, at first glance the most impressive feature of the '49 Ford is the complete departure from previous exterior design. The body has been made full width, with rear fenders integral with the rear quarter panels. Front fenders are more massive and have higher crowns, giving an almost unbroken line from side to side across the hood. The clean, smoothly-flowing horizontal lines of the body are evidence of the careful attention paid to this design detail. Wind noise and air resistance are reduced and, of course, usable space within the body is greatly increased by the full width design. In the process of achieving



Up to 57% more luggage space.

this smoothness of design a number of the dirt and moisture collecting seams found in conventional designs are eliminated.

Stainless steel moldings extending horizontally backwards along the sides of the body, do double duty as protective rub-tails. Extra-heavy "Fender Guard" bumpers curl around the sides of the fenders for added protection. On all models the trunk capacity has been markedly increased. Usable trunk volume is 28.5 cubic feet in coupes; sedans have 19 cubic feet, an increase of 57%. The trunk lid is externally hinged and provided with an ornamental handle incorporating the license plate lamp, and license plate holder.

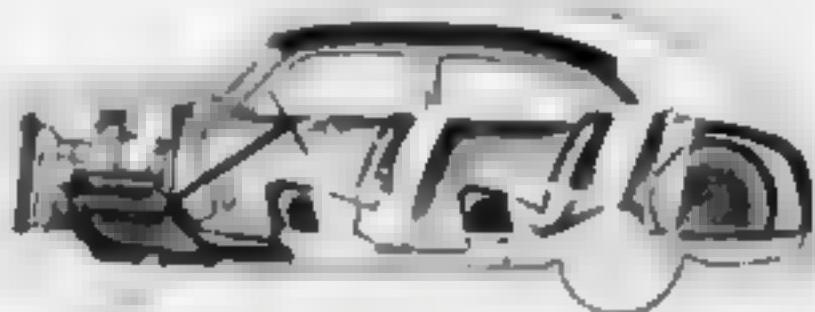
Body construction is likewise completely new, affording greater strength and safety with reduced weight. The combined body and frame structure is actually 59% more rigid. It is of the all steel, all welded type, incorporating material and design features that reflect over 21 years of research into the problems of combining maximum strength with minimum weight. The body is bolted firmly to the frame at 22 points, with special shims provided for insulation. Front pillar posts have a narrow cross-section to improve visibility. Another interesting innovation is that the rear wheel housings are completely separated from exterior sheet metal and welded to the rear floor pan. This increases stiffness at

the rear portion of body and provides exceptionally solid footings for the full-arch roof rails.

Insulation. Bodies are effectively insulated against heat and noise, a variety of methods being used. Roof, floor and deck lid panels are lined with a special waffleboard-type insulation. Sprayed-on sound-deadening materials are used for door panels, quarter panels and wheel housings. In addition, the dash is insulated by the use of heavy fabric material.

All structural members in the new Ford bodies are carefully cleaned, treated with a rust inhibitor and painted. This treatment is applied even to the inside surfaces of such large box-section members as the center pillars, in which special openings are provided for the purpose

"Lounge Car" Interiors of the Ford "Forty-Niner" show every bit as much change as the exterior body lines. Most important advancement is the great increase effected in usable space. This has been accomplished, in part, by moving the engine 5 inches forward. Extending the body sides outward to the full width of the car likewise results in substantially increased seat widths, particularly at the hip and shoulder levels. Front seats are 57" wide, an increase of



White outline—'48 Ford; gray outline—'49 Ford.

6.5", while rear seats now measure 60", or $7\frac{3}{4}$ " more than before. 56" shoulder room has been provided in the front seat and 55" in the rear seat of sedans, enabling three large people to occupy each seat with complete comfort.

Added riding comfort is obtained by scientifically positioning seats well forward between the wheels, resulting in a smooth, soft "Mid Ship" ride. Also new for Ford this year is the seat construction employed — lightweight tubular frame containing a unique "zig-zag" spring base and short, soft-acting coil springs.

Visibility. Another important achievement in body design has been accomplished by Ford engineers in substantially increasing the window area of the new models, while at the same time lowering the overall height of the body over 3". The greater visibility provided for both driver and passengers alike is an important contribution to greater safety of operation, as well as adding to comfort and pleasure. The total vision area in the popular Tudor model, for example,



Midship Ride

has been increased from 2612 square inches to 2916 square inches. The extra-wide and extra-deep V-type windshield gives over 20% more vision area than before.

Instrument Panel. In keeping with the high quality and luxury feeling of the new Ford interiors, the instrument panel has been completely restyled to combine beauty and utility. Oil pressure gauge, fuel gauge and battery charging and engine temperature indicators have been grouped in a single cluster around the rim of the 100 mph. speedometer directly in front of the driver. The speedometer face also contains the headlight beam indicator light, and provision for turn signal indicators. A completely non-glare lighting system is employed to illuminate the gauges and speedometer. Based on the "black light" system developed during the war for illumination of aircraft control panels, the Ford system uses a light that approximates ultra-violet and is invisible to the human eye. Instrument figures, graduations and pointers are coated with a substance that emits a clear glow when acted upon by the "black light" rays, thus becoming easily readable in the dark with no distracting bright light or reflections.

Custom models have a clock in the center of the instrument panel and locking glove compartment at the far right. Provision is made for the installation of a radio below the clock, with speaker grille located at the top of the panel next to the windshield. Tests show that this high-level speaker placement gives greatly improved acoustical reception for all passengers.

Controls. The popular dash-mounted starter button has been retained. The windshield wiper

control has been placed within easy reach on the instrument panel, along with a three-position light switch, three-position ignition switch and lock, choke control, and on the Custom models, an automatic cigar lighter. An ash tray is also provided in the panel. Operating controls and their placement follow standard practice, a two-spoke steering wheel being used to provide unobstructed vision of the gauges and speedometer cluster. A T-handle pull-type parking brake control is used in place of the pistol-grip type.

Two upholstery choices will be available in the Custom series—blue-gray tweed broadcloth and a gray-green striped mohair. In the Ford series, green striped broadcloth or green and red striped mohair is offered. Both series may be had tailored in tan leather, at extra cost. The convertible model comes in either red leather combined with beige bedford cord, tan leather with beige bedford cord, or green leather with green bedford cord, depending on the exterior body color selected. Station Wagons have genuine leather upholstery on driver's seat and vinyl is used on passenger seats.

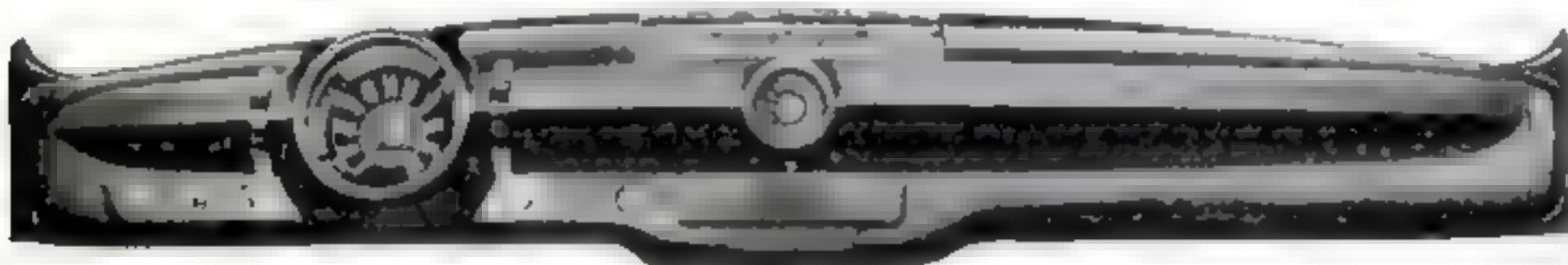
Door controls have been extensively modified to give greater ease of operation and safety. Outside door handles operate by pulling outward. Inside door handles pull up to open, thus eliminating the possibility of accidentally opening a door by leaning on the handle. Also, possibility of snagging clothing is minimized by placing open ends of handles towards front of car. Door lock inside controls are push buttons which return to open position whenever the door is opened or closed. It is thus impossible to lock the keys in the car. Ignition key operates

exterior door locks located in both front doors. Either right or left door may be opened with the key, regardless of which one was locked from the outside originally.

Appointments. Ford models are provided with a variety of interior appointments, including arm rests at each side of both front and rear seats in sedans and club coupes, an ash tray in both front and rear compartments, coat hooks, interior light and sun visor. The Custom models are equipped in even greater detail, with extra quality upholstery and floor mats, cigar lighter, robe and assist cords, clock, dual sliding-type sun visors, two ash trays in rear compartment and two interior lights.

maintain nearly constant temperature inside the car regardless of outside temperature. Thermostat is set by a push-pull knob on dash. All the way out permits maximum flow through the coil, and all the way in shuts off flow completely, permitting blower to be used in hot weather for forced circulation of fresh, low-humidity air.

Defroster operates in conjunction with heater. A push-pull knob on dash regulates dampers inside the heating coil box, directing warm air to the windshield. When defroster knob is pulled out to its "full out" position, full discharge from the powerful blower flows through the defroster ducts to remove heavy ice from windshield quickly on the coldest day.



Instruments are grouped directly in front of driver, and "block lighted".

A Living Room on Wheels—that's the overall impression created by Ford's new combination of increased visibility, greater usable interior roominess, extra-wide seats and smartly styled materials and fittings. This comparison is further heightened by Ford's new ventilating system, which admits fresh air through screened openings next to the radiator and discharges the air into the car body just above the toe boards. Each inlet is individually controlled by knobs on the steering column bracket. The forward movement of the car produces a ram effect in the air intake, delivering fresh air under pressure. This pressurized ventilation permits vent windows to be opened slightly even in rainy weather to maintain air circulation.

The three-way "Magic Air" heating system (available at extra cost) is designed to operate in conjunction with this new ventilating system. A two-speed blower takes air from the right-hand air intake and passes it through a heating coil. The warmed air then enters the car body through an outlet that extends across the dash above the toe board. A three-way valve permits operation of the system as either (1) a fresh-air heater with forced circulation for cold weather or quick warm-up; (2) a fresh-air heater without blower for milder weather; (3) with intake closed, as a recirculating heater for quick heating in very cold weather or to keep out obnoxious fumes in heavy traffic.

A thermostatically-controlled valve regulates flow of hot water through the heating coil to

Two New Engines: For the "car of the year" Ford provides a choice of two engines—a new V-8 and a new Six. The following are the basic engine specifications:

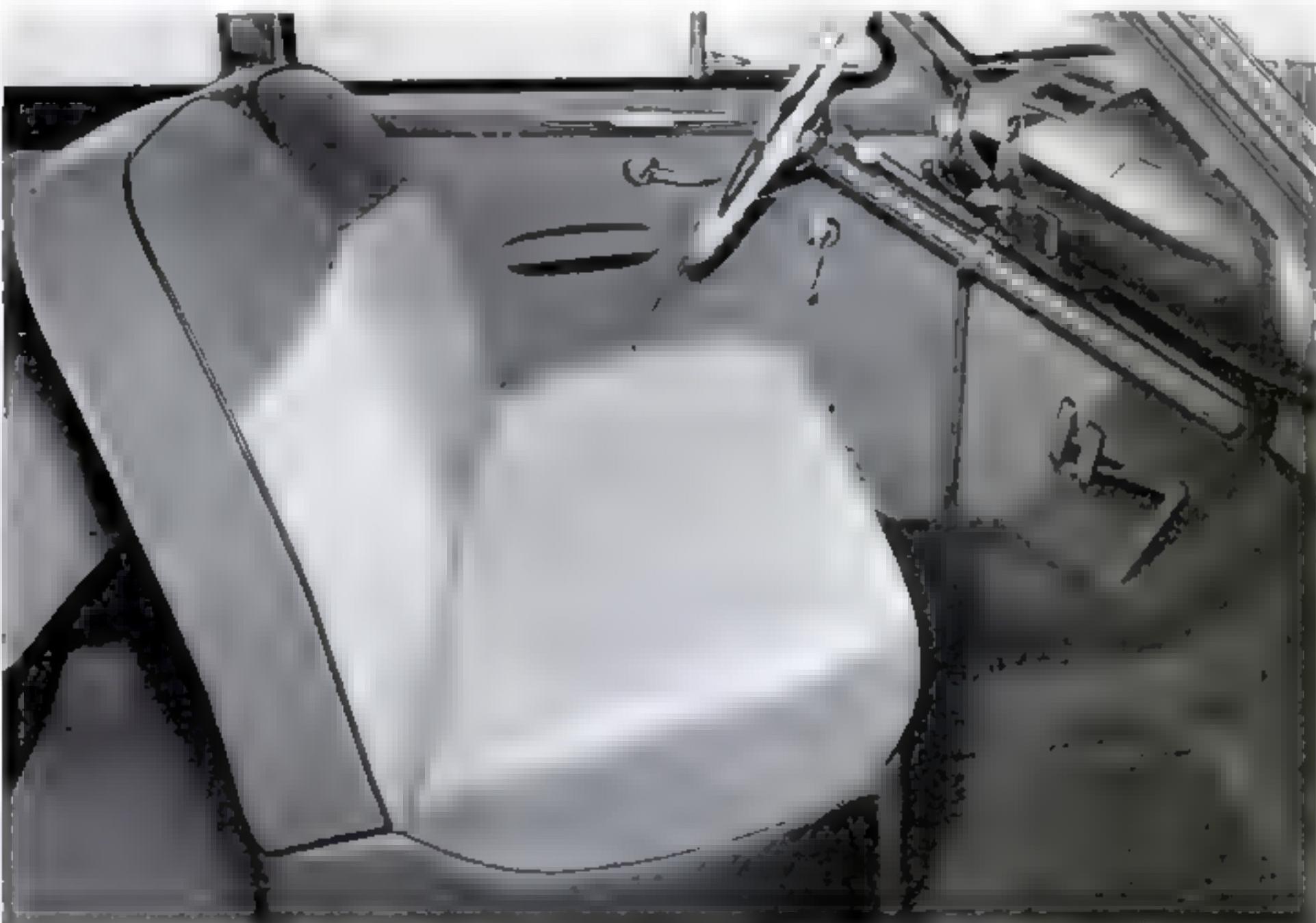
| | SIX | V-8 |
|-----------------------|-----------|------------------|
| Type | I-head | I-head, 90° v.v. |
| Displacement, cu. in. | 225.9 | 239.4 |
| Bore x Stroke, in. | 3.3 x 4.4 | 3.3/16 x 3-3/4 |
| Max. brake hp. @ rpm. | 95 @ 3300 | 100 @ 3600 |
| SAE—AMA hp. | 26.1 | 32.5 |
| Compression ratio | 6.0 to 1 | 6.0 to 1 |

Both V-8 and Six cylinder engines incorporate many radical changes in design and construction which decrease power losses, increase engine efficiency, provide exceptional accessibility for servicing and assure longer engine life. The major changes incorporated in both engines include: a new "Equa Flo" cooling system with balanced type thermostat and pressure type radiator cap; greatly improved lubrication system; new combustion chamber contours; redesigned intake manifolding; unique vacuum differential spark advance regulation; new single breaker-type distributor mounted for easy accessibility; more effective crankcase ventilation; timing mark on pulley or damper at front of engine and a carefully engineered 3-point rubber mounting system.

The new V-8 engine has an off-center location of oil passage in each crank pin, providing a "sludge pocket" designed to trap foreign matter carried over from main bearings. Individual steel-backed precision-type bearings are locked in the end of each connecting rod replacing the single floating type formerly used for each pair

of rods. V-8 valves are precision set and periodic adjustment is not required. Valves are straight stemmed and guides are one-piece type for better heat transfer and more effective lubrication. Heat and wear resistant valve seat inserts are used at both intake and exhaust valves.

completely new body design with greatly reduced air resistance; (2) the new cooling system which permits higher engine operating temperature with consequent decrease in heat loss to coolant and a decrease in internal friction resulting from higher lubricant temperature, (3) improved



Seats are "safe wide" and trimly upholstered in modern fabrics.

The Ford 6-cylinder engine block has been increased in height and connecting rods have been made longer with consequent decrease in side-wall thrust. Larger main and connecting rod bearings are provided. Cylinder walls are lubricated by pressure spray from a drilled hole in lower end of each connecting rod. An extra-quiet rotor type oil pump is gear driven from center of camshaft. Another innovation is provision for installing a base-mounted oil filter (at extra cost) connected directly to the engine lubrication system by drilled holes, thus eliminating all external oil lines. Valve mechanism on the Six is completely new with high-lift cams, pressed-in valve guides, and self-locking, adjustable tappets. Either the modern viscous type or the efficient new rubber type vibration damper is bolted to front end of crankshaft.

Savings in gasoline mileage of up to 10% have been achieved. The major factors responsible for this increased economy are: (1) the

manifolding with more even distribution to each cylinder. (4) new combustion chamber contours permitting high (6.8 to 1) compression without detonation even when using non-premium fuels.

Lubricating oil is forced under full pressure to camshaft, crankshaft, main and connecting rod lower bearings through passages in engine block, in both V-8 and Six. On the V-8, timing and distributor drive gears are lubricated by an intermittent pressure spray while cylinder walls, pistons, pins, valve mechanism and oil pump drive gears are lubricated by throw off from the bearings. Cylinder walls, pistons, and pins on the Six receive oil under pressure from a drilled hole in lower end of each connecting rod while timing gears, distributor and oil pump drive gears are lubricated by throw off from bearings.

The new "Equa-Flo" cooling system gives an equal flow of coolant throughout every part of the system. The high-capacity water pumps

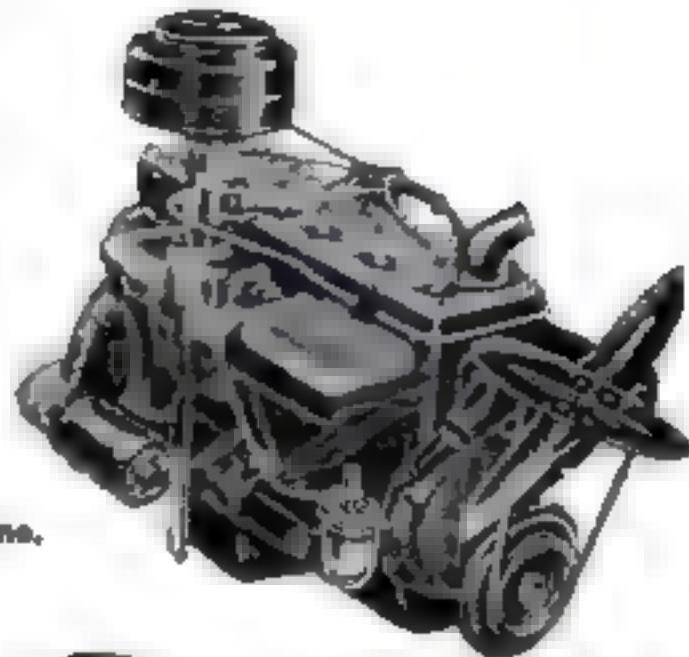
(two on V-8, one on Six) force all coolant directly to rear of block, thence up into head and back to radiator. Turbulence is high as a result of the high velocity, improving heat transfer. Uniform temperatures are maintained with no possibility of hot spots. No special provision is required for valve seat cooling. A pressure-type radiator cap is used on the flat tube and fin-type radiator, permitting a maximum pressure of about $4\frac{1}{2}$ pounds in the cooling system with a correspondingly higher, more efficient coolant temperature. Loss of coolant is practically eliminated by use of the pressure type cap. New balanced type thermostats, which are not affected by water pressure, are used on both engines for quick warm-up and a recirculating by-pass at each pump assures uniform temperatures during warm-up period.

Fuel pump on both engines operates at higher pressure, reducing possibility of vapor lock. On the V-8, pump is in center and at rear of block away from the hot exhaust manifolds. A special shield is provided on the Six to protect fuel pump from heat given off by manifold.

The generator is rated at 30 amperes at 7 volts and is air cooled. A three-way regulator maintains constant voltage, limits current output and prevents battery discharge through the generator. Ignition wiring is provided with heavy synthetic sheathing that is highly resistant to moisture, oil and ozone.

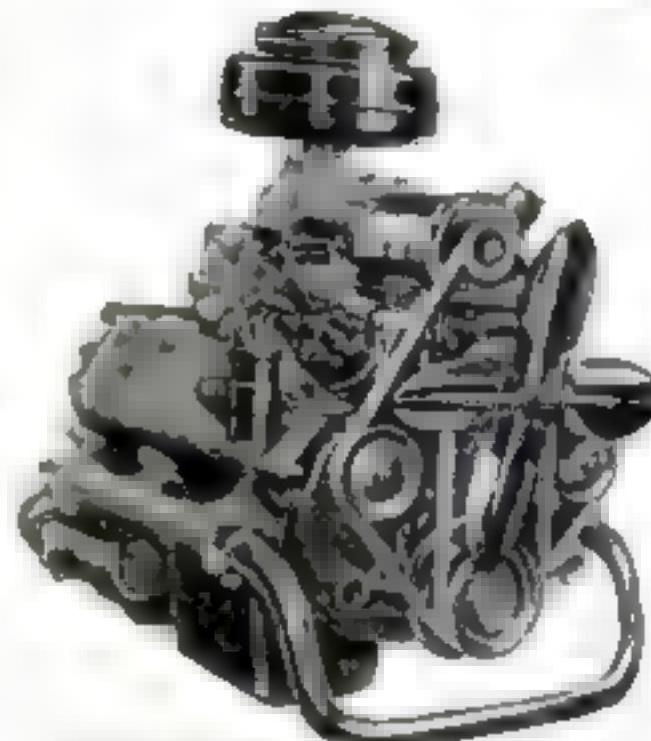
Economical Service. The new Ford engines are designed for quick, economical inspection and service. Engine accessories are positioned well above the center plane of the engine where they can be reached easily. The distributor is near the top of engine, and ignition wires are held in place by rubber grommets. A timing mark is provided at front of engine where it can be seen clearly. For quick, easy servicing of bearings, oil pump intake screen, etc., oil

SIX



Ford Six Engine.

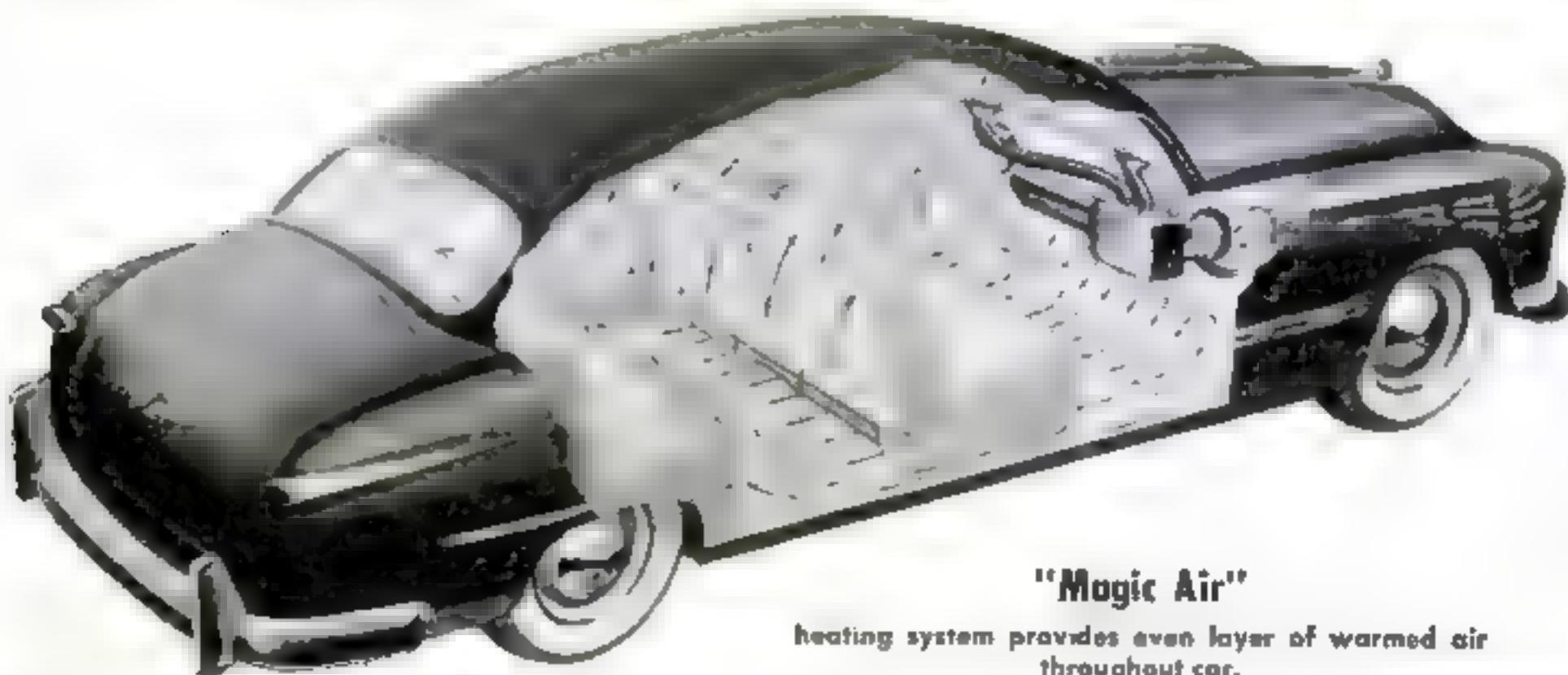
V-8



Ford V-8 Engine.

pan removal has been made as simple as possible on both engines. This careful and thorough attention to engine design, permitting easy maintenance, will be an important '49 Ford feature for both owners and mechanics.

Road lighting is provided by sealed beam headlights which can be readily adjusted both horizontally and vertically. Twin parking lamps are located in the radiator grille and dual combination tail- and stop-lights blend into the rear contour of the car. Provision is made for install-



"Magic Air"

heating system provides even layer of warmed air throughout car.

ing directional signal indicators in the parking and taillights. The license plate is illuminated by a light in the trunk lid handle.

New Suspension. Of great interest to automobile enthusiasts is the fact that, with the introduction of the "Forty-Niner," the transverse spring suspension that has long been almost a Ford trade-mark has been done away with. The new Fords for '49 have a completely new suspension system, using "Para-Flex" rear springs and "Hydra-Coil" front springs. Both elements of the system have been carefully engineered to work in complete harmony with each other, for a balanced, cushioned ride.

The "Para-Flex" rear springs are, as the name implies, semi-elliptic leaf springs mounted parallel to the frame. Impregnated inserts between tips of spring leaves, together with concentrated pressure-type rubber bushings at shackles and brackets, make lubrication unnecessary. Rear shock absorbers are hydraulic double-acting aircraft type.

The "Hydra-Coil" front springs have double-acting hydraulic aircraft-type shock absorbers mounted inside them. This method permits the shock absorbers to be readily removed and replaced, without even jacking up the wheels, and the springs protect them from flying stones, etc.

Swinging link independent front wheel suspension is employed to permit either wheel to move up or down without effect on the other. A new, one-piece, rubber-mounted stabilizing bar across the front assists in controlling side sway of the car on curves and turns.

Frame. Serving as the backbone of these new Fords is a completely new double-drop frame, with big box-section side rails 4 inches deep and $3\frac{1}{4}$ inches wide. Two heavy gauge channel sections are welded together at their flanges to form the box-section, which extends from front suspension cross member to center of kick-up at rear axle. Weld is continuous throughout the box-section. Five cross members are used with an exceptionally large box-section front



The new Ford Six engine develops 95 h.p.

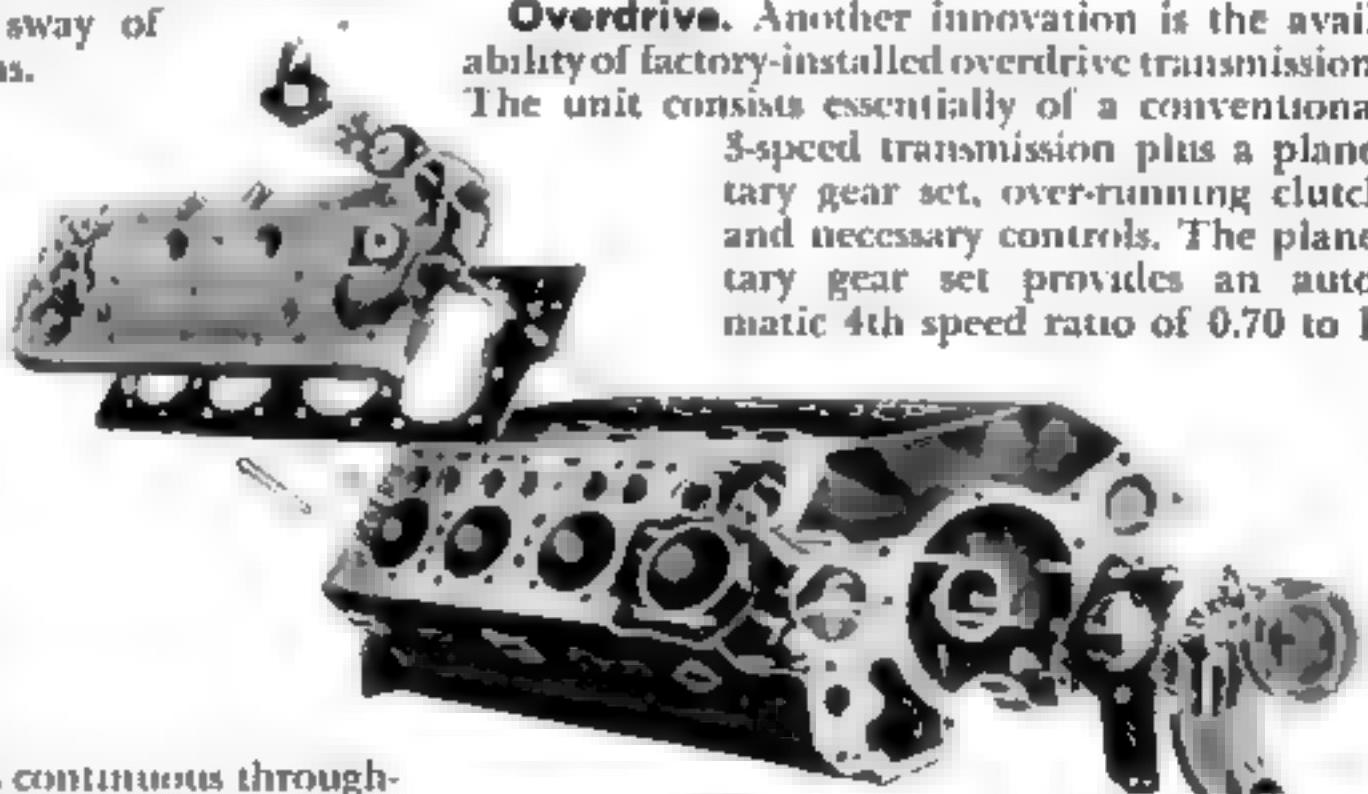
suspension member. Frames for the Convertible and Station Wagon models are further reinforced to compensate for the inherent loss of body rigidity in the former and the normally heavier loads to be expected in the latter.

Another chassis change for '49 is the adoption of Hotchkiss drive in place of the former torque tube and radius rod system. In this new system all driving and braking forces are transmitted through the rear springs, giving smoother, more comfortable starts and stops, and reducing unsprung weight.

Axle Ratios. A further development is the use of a new semi-floating rear axle, with hypoid ring gear and pinion carried in an extra-strong, light-weight banjo housing. Hypoid design, together with the forward location of the rear seat, practically eliminates drive line tunnel in rear compartment floor. Single row, ball type wheel bearings are permanently lubricated. Rear axle ratio, standard, is 3.73 to 1; with overdrive, 4.10 to 1. An optional ratio of 4.10 to 1 is designed for use in the mountains. The heavier Station Wagon model has a 3.91 to 1 axle ratio as standard and 4.27 to 1 with overdrive.

The transmission of the '49 Ford is of conventional 3-speed type, with shift lever mounted on the steering column. Quiet, long-life helical gears are used in all speeds. Transmission ratios are as follows: 1st, 2.819; 2nd, 1.604; 3rd, direct; reverse, 3.625.

Overdrive. Another innovation is the availability of factory-installed overdrive transmission. The unit consists essentially of a conventional 3-speed transmission plus a planetary gear set, over-running clutch and necessary controls. The planetary gear set provides an automatic 4th speed ratio of 0.70 to 1.



One factor in the increased economy of the '49 Ford is the "Equa-Flow" cooling system.

Shift into overdrive gear is made at any time after car reaches a speed of about 27 mph. by simply releasing accelerator pedal for an instant. Car remains in overdrive until speed drops below about 21 mph. at which speed the drive reverts to regular 3rd gear. Driver may shift from overdrive back to 3rd gear at any time by depressing accelerator past wide open throttle position. This operates a "kick-down" switch that permits transmission to shift back to regular 3rd speed automatically, to provide for faster acceleration in passing other vehicles or for better hill-climbing ability.

The rear axle ratio on cars equipped with the new overdrive is 4.10 to 1, in place of standard 3.73 to 1. With overdrive in operation,



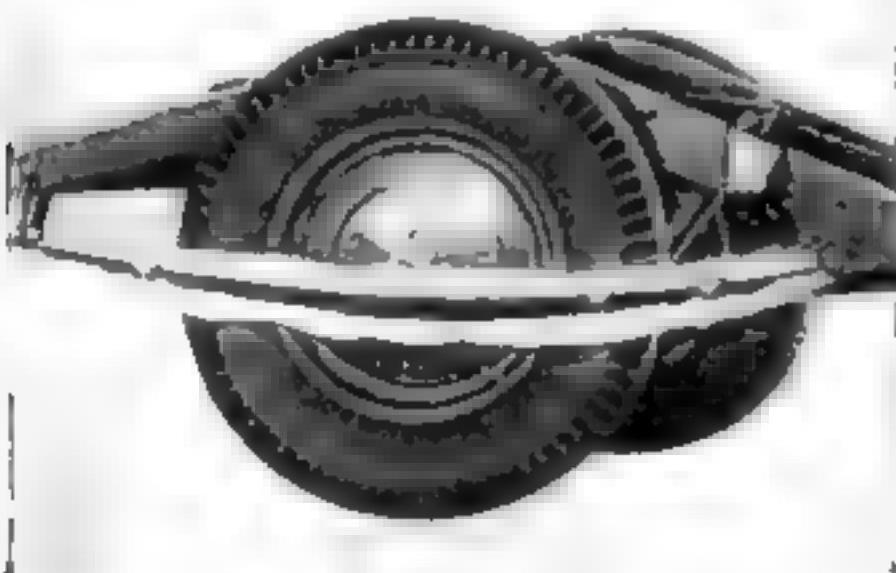
Hydraulic brakes are "King-Size", operate with easy feather-light pedal pressure.

engine speed is 23% lower than in a car with standard axle and no overdrive. The result is smoother, quieter operation, longer engine life and a marked increase in fuel economy. The 4.10 to 1 axle provides exceptional performance for acceleration and hill climbing.

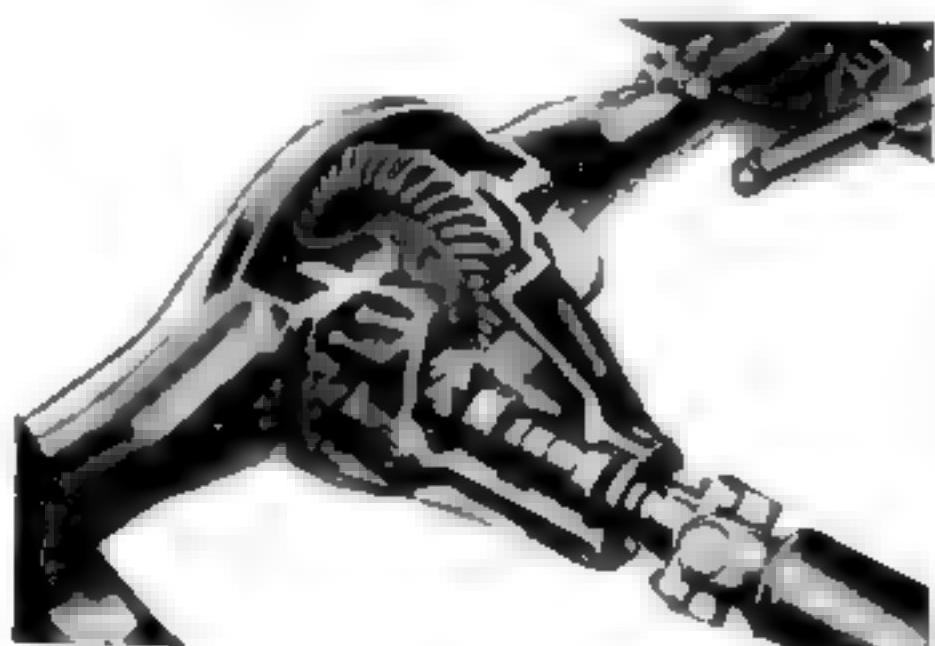
New "King-Size" hydraulic brakes with "Magic Action" touch have been developed for both series. These utilize the energy of the car's momentum to aid in applying the

brakes, thus decreasing the pedal pressure required for a given deceleration rate as much as 35%. Brake area of 177 square inches is an indication of the ample margin of safety provided for a car of this size and weight.

Tires. On all models except the Station Wagon 6.00 x 16 4-ply tires on wheels with 4½-inch rims are standard equipment and the new super balloon 6.70 x 15 4-ply tires on 5-inch rim wheels are available at slight extra cost. Station Wagons are equipped with 7.10 x 16 6-ply super balloon-type tires on 5-inch rim wheels as standard equipment.

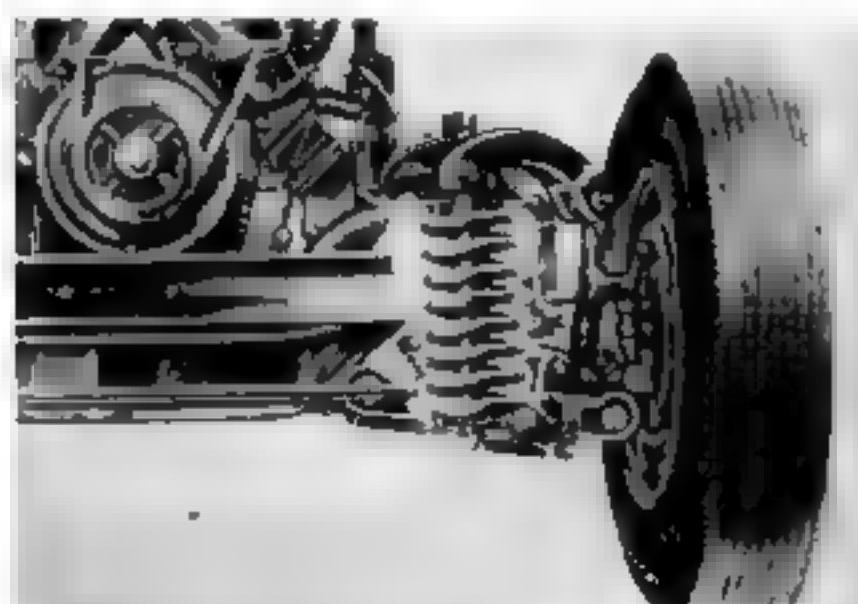


"Para-Flex" Rear Springs are made extra long, extra strong for smoother riding.



Cut-away view of new Ford axle and differential showing hypoid design.

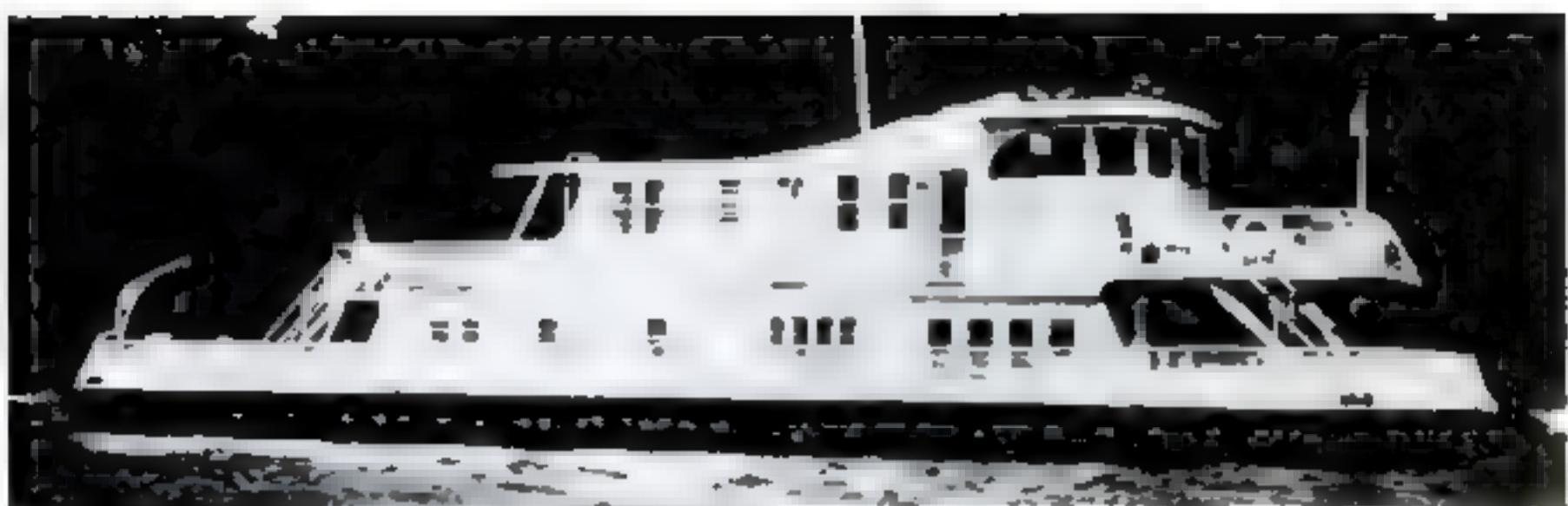
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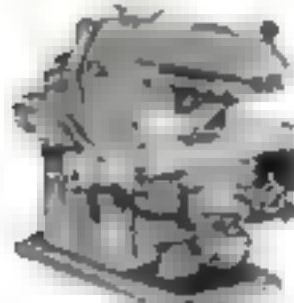
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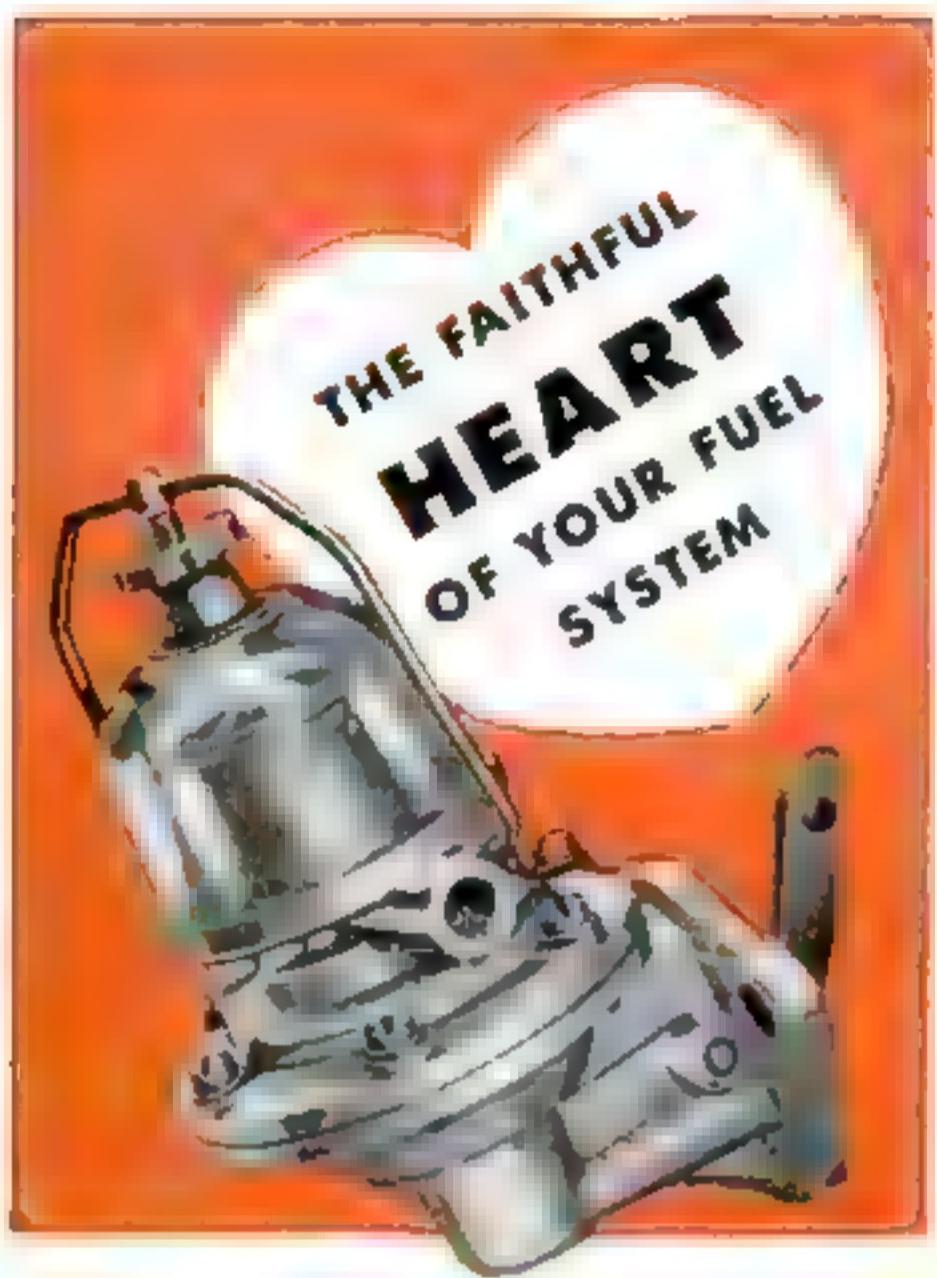
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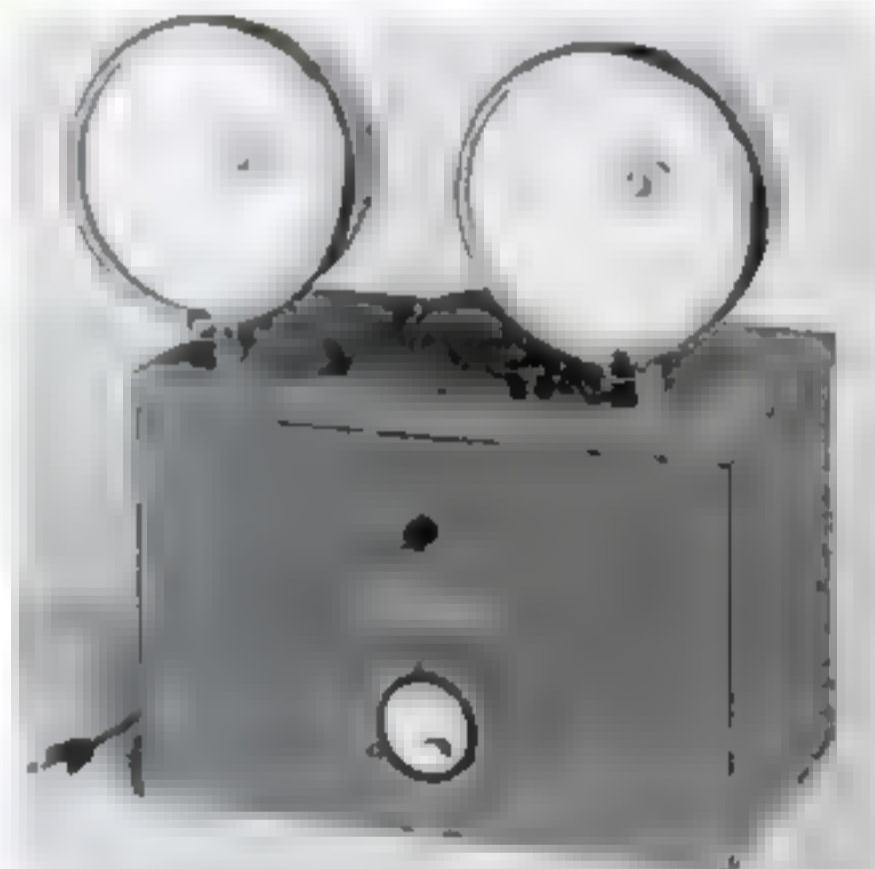


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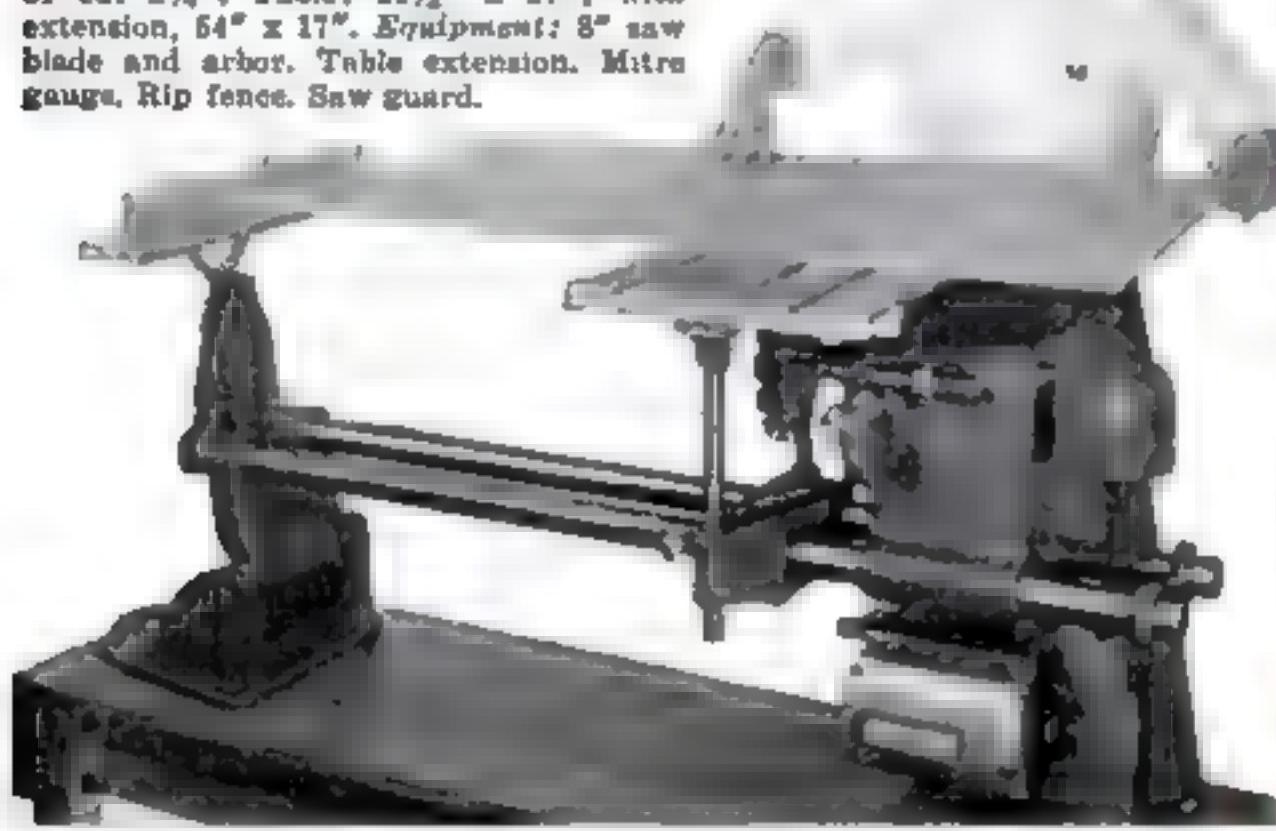
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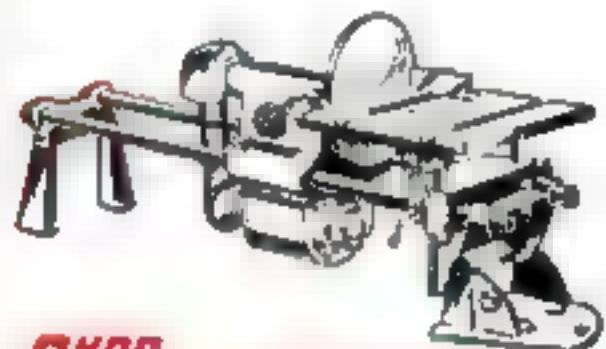
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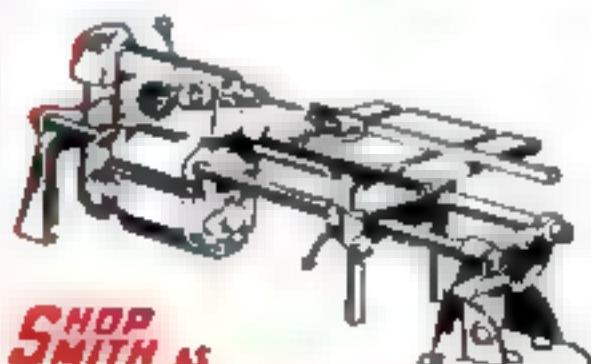
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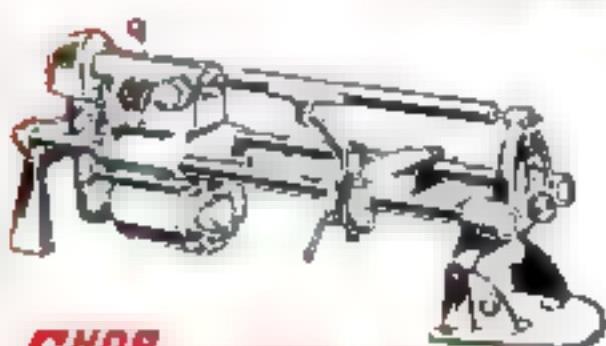
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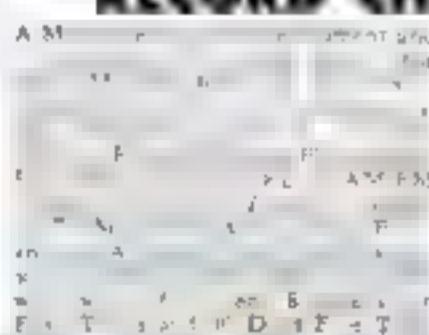
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EYESTRAIN is eliminated when workers in poorly lighted areas use this tally board with lamp attached. Its lighting assembly has a three-volt bulb and three standard flashlight cells, assuring long battery life. Designed for heavy duty, the entire unit weighs only 24 ounces. The manufacturer is Clyne Mfg. Co., of Cincinnati, O.



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FEWER sheets of carbon paper are wasted by a typist if she uses a new, moisture-resistant type of tissue that will not curl. This is accomplished by applying a coating of Vinylite [®] plastic to the back of each sheet. In addition, the new carbon paper is said to be less likely to tear in handling.

IT'S NEW! HERE'S YOUR RIFLE, SON



Write for folder
or see your
Dealer

It's a he-man shootin' .22 with more new features than you ever saw in a popular priced rifle. You'll go for the new "Red Devil" sight; the "Redi-Feed" drop-in loading platform, streamlined bolt, self-cocking and side thumb-safety features.



"Pioneer" 765

"REDI-FEED"
Drop-in
▼ Loading platform

PRICE
\$13.50

This rifle is newly designed and streamlined throughout for fast, safe, accurate shooting. It's full size, for the fullest measure of shooting pleasure. No other rifle at this price has all the new features of "Pioneer" 765.

HARRINGTON & RICHARDSON ARMS CO.

356 PARK AVENUE, WORCESTER 2, MASS.



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Moto-Tool Kit No. 2, with 23 accessories \$10.00 you save \$6.00
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A TESTED TOOL THAT PACKS YEARS OF PLEASURE

If you get a kick out of making things you'll have fun with a Moto-Tool. It grinds, drills, cuts, carves, polishes, does work better, faster, on practically any material. Moto-Tool is backed by 16 years of successful industry service. And used by every branch of Armed Forces. Compare Moto-Tool with other grinders and see for yourself why it's better.

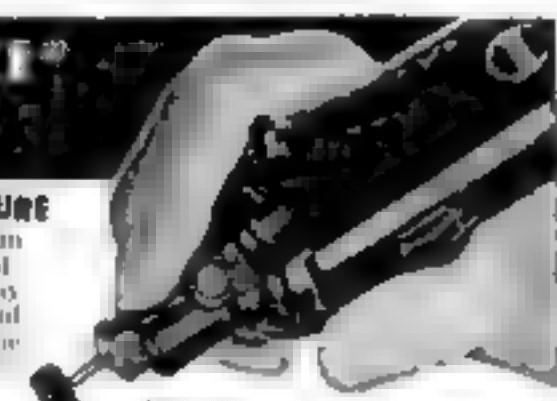
10 Reasons Why Moto-Tool's a Better Buy

1. Larger, sealed bearings. 2. Patented automatic chuck lock pin. 3. Oversize armature. 4. Extra hardened ground, polished. 5. 110 V. or 115-120 V. motor. 6. Sliding snap-type switch. 7. Handy hanger hook, used practice. 8. Shock proof base to housing. 9. Dust filtered air cooling system. 10. Dynamically balanced for vibrationless operation. Weight only 1.9 lbs.

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Buy Dremel Moto-Tools from your dealer. If he cannot supply you direct from the factory on 10 day trial money back guarantee. Ship paid postage for payment to fail and we'll do money back. Or send only \$2. we will ship C.O.D. via fast postman facilities plus postage. Call for list of Moto-Tools and Accessories. FREE!

DREMEL MFG. CO.
Dept. 120-H Racine, Wisconsin



Approx.
27,000 R.P.M.

New DREMEL DRILL PRESS

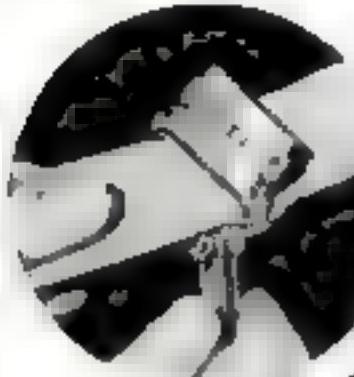
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(Less Moto-Tool)

Here is a portable precision drill press. All tools attach directly to the base. Just flip the thing for reaming, counter沉ery, model making, wood work, fine routing, etc. Utilizes Model No. 2 Moto-Tool which can be used or inverted, swung in any direction, or quickly removed for off-hand use. 110 V. Power. 1/2" H.P. 1725 R.P.M. In 48" x 12" Weight approximately 115 lbs.



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REEVES Army Twill is a double duty fabric that's right for work and play. It's highly resistant to wear and tear, and its wide variety of vat dyed colors are fast to sun, water and perspiration. Being Sanforized*, it can take repeated washings and still come up fresh and new. For better looks and longer wear—demand Reeves Army Twill.

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DUAL INTAKE MANIFOLDS for V-8 FORDS AND MERCURYS

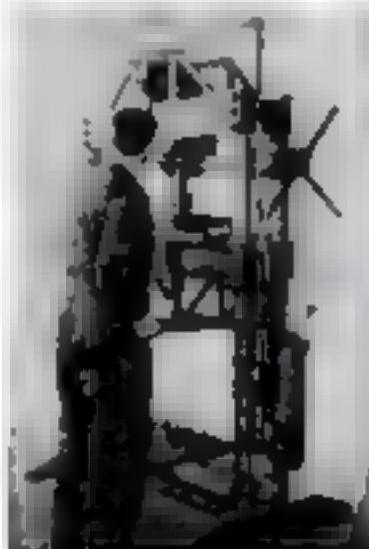
\$15.00 One Line and Throttle Kit
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Chrome Plated Velocity Stacks — \$1.40 ea.

By Test Increased Acceleration by 20%
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Twice-Told Tips

Browsing through back numbers is a favorite pastime of many POPULAR SCIENCE readers, and they have found many new uses for old ideas. Here are some old standbys that haven't deteriorated with age.



Electric Tester Quickly 'Candles' Eggs

Jan. 1922 Eggs are not always what they seem. An inspection of the shell gives no idea of the condition of the yolk. Here is an egg tester that will reveal the hidden inner truth. Make a cardboard funnel with the small end just large enough to take the bulb end of an electric flashlight. Close the large end of the funnel with a cardboard disk in which there is a hole just large enough to cradle the egg nicely. White cardboard, which will reflect the light, should be used for the egg holder. When an egg is put in place, it can be quickly "cuddled" merely by flashing on the light.

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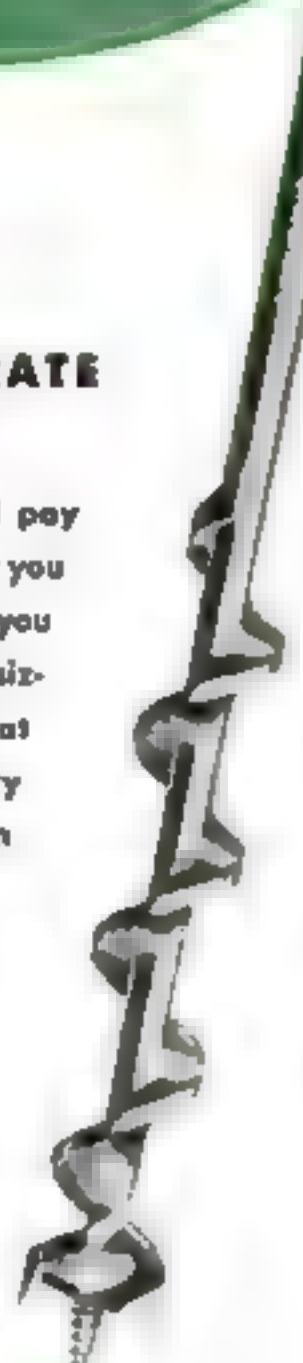
Dusty Gray Finish for Oak

Sept. 1927 A gray antique-looking finish can be given to oak by covering the wood with two coats of a 5-percent solution of silver nitrate, followed by a solution of hydrochloric acid. Set it aside to dry in a dark place, then neutralize the acid with a coat of ammonia. This should



FOR FAST, ACCURATE WORKMANSHIP

GREENLEE 22 is a name it will pay you well to remember whenever you buy Auger Bits. For it assures you sharp cutting edges, accurate sizing, bright, high finish, and that smooth, easy action so necessary in fine craftsmanship. You can be certain, too, that every GREENLEE 22 Solid-Center Auger Bit is "factory sharp" when it reaches you. For each is "Plastic-Sealed" with a special protective coating to keep it in perfect condition for you. To buy top quality, buy GREENLEE.



SPECIAL OFFER... ONLY 10¢ FOR HANDY WOODWORKING CALCULATOR

Quick solutions to countless woodworking problems. Just set dial; convert linear feet to board feet; compare characteristics and workability of various woods. Also shows bit sizes, nail specifications, tool sharpening hints, etc. Heavily varnished cardboard, 6" diameter. Send 10¢ to Greenlee Tool Co., 2128 Columbia Avenue, Rockford, Illinois, U. S. A.



BUILD YOUR OWN 2500 WATT ELECTRIC LIGHT PLANT

All you need is an electric generator, a small engine to drive generator at proper speed, 2 dual sheaves; 2 V-belts, and a welded angle iron base. No wiring is involved, and you do not need to know anything about electricity to make this assembly.

Start out by buying the 2.5 KVA Leland Alternator shown above. It is a 120 volt, 60 cycle, single phase, A.C. generator, complete with radio filter box, and self regulating voltage. It must turn at 1800 r.p.m. for bright, even lighting. Requires 3 1/2 H.P. to turn generator at full load—so buy an engine of at least 5 H.P. to have plenty of reserve. We will ship you the GENERATOR ONLY, without pulley or belts, for \$125.00 freight prepaid. If your needs are urgent, we will assemble your set, using above generator and a 6 H.P. Salsbury gasoline engine, manually started, governor controlled, and ship to you \$297.00 freight prepaid. Same unit but with Ensign conversion to run on natural gas \$347.50 freight prepaid.

To eliminate time lapse for personal checks to clear, we suggest remittance by bank draft or cashiers check.

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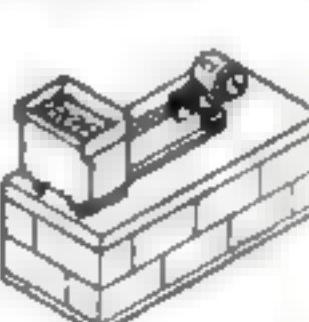
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BUILD THIS CONCRETE BLOCK MACHINE

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This simple machine which you can build yourself at a cost of about \$5.00 (excluding motor) will make a block in 30 seconds using only one form. 2 to 4 forms can be used in each vibration.

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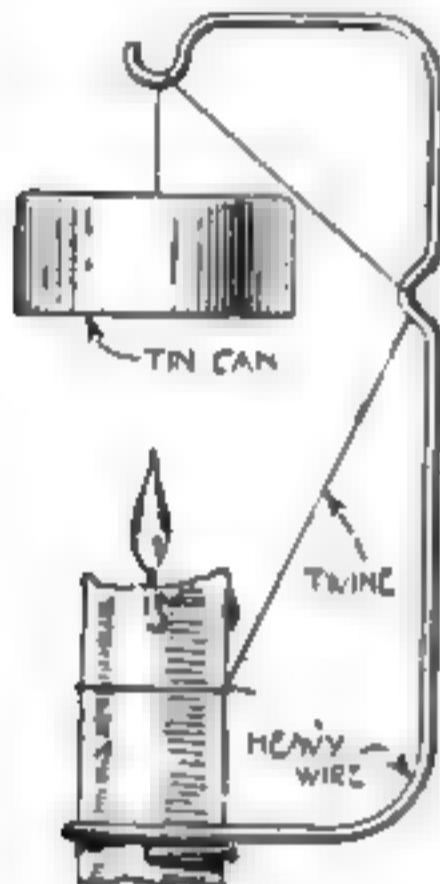
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be applied out of doors, since the fumes are very powerful. Do not touch the work with your fingers during the process, for the marks may show. Finish with well-rubbed coats of paste floor wax.

A gray finish like the one that results from this treatment is now being used on oak pieces of modern design.



A Simple and Automatic Candle-Extinguisher

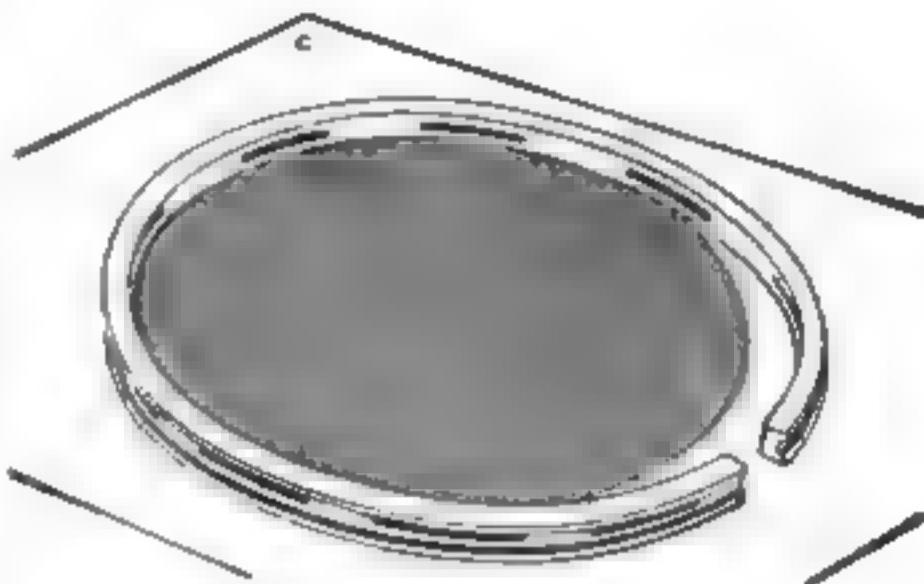
Apr. 1921 A simple arrangement to make a candle extinguish itself within a given time is shown. A support of stout wire is twisted around the candle, bent in a semicircle a little more than half-way up, and ended in a loop. A small can is cut to act as an extinguisher. A piece of thin twine is pushed through the center of the can and tied with a knot. The thread is carried over the hook in the support and through the curved part, and finally is tied around the candle. Roughly, an average candle will burn half an inch an hour. To have the candle extinguished in an hour simply tie the twine half an inch below the top of the candle. When the wax has been burned away to this point, down comes the extinguisher.

• • •

Old Bill Says . . .

Nov. 1931 When boring holes that are to be held to decimal dimen-

DON'T YOU BELIEVE IT! THAT PISTON RINGS ARE ROUND



Many people are under the impression that piston rings are made round. Burd "Graf-Flox" Piston Rings are purposely made *out-of-round* to insure uniform tension and perfect roundness when the rings are compressed around the pistons within the engine cylinders. Each type of ring has its own special metal formula to impart the right degree of hardness, flexibility, tension and long life for its specific use. The exclusive "Graf-Flox" process insures faster seating . . . without danger of rings scoring, seizing, or sticking in piston grooves. Burd "Graf-Flox" Piston Rings stop fuel and oil losses . . . restore pep and power. The coupon will bring you more information in two FREE booklets.

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Rockford, Illinois

I'd like copies of your "Homeowner's Handy Handbook," which tells how to keep my car in good working order, and the booklet "Me Job For a Dab."

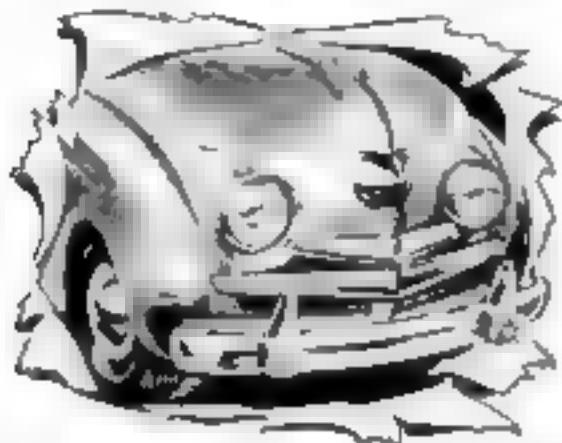
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See the stand-out styling of the Crosley Station Wagon. All steel. Seats 4 or 2 with 1/2-ton load. Priced \$600 to \$700 lower than any other station wagon, costs about 1/2 as much to operate. Also available as a panel delivery truck without rear side windows.

And all five Crosleys have the new look, massive radiator louvers and a gleaming spinner adapted from aircraft propellers. Every model features the startling 4-Cylinder Cobra (COpper-BAAzed) engine.

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If you love sun
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STRIPING TOOL**

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inch wide, it strips paint from 1
inch to 1 1/2 inches wide. It
strips paint from 1/2 inch to 1
inch wide. It strips paint from
1/4 inch to 1/2 inch wide. It
strips paint from 1/8 inch to 1/4
inch wide. It strips paint from
1/16 inch to 1/8 inch wide. It
strips paint from 1/32 inch to 1/16
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1/64 inch to 1/32 inch wide. It
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1/5192295732430295668992 inch to 1/2596147866215147834496 inch wide. It
strips paint from 1/10384591464605591337984 inch to 1/5192295732430295668992
inch wide. It strips paint from
1/20769182929211182675968 inch to 1/10384591464605591337984 inch wide. It
strips paint from 1/41538365858422365351936 inch to 1/20769182929211182675968
inch wide. It strips paint from
1/83076731716844730703872 inch to 1/41538365858422365351936 inch wide. It
strips paint from 1/16615346343368541407768 inch to 1/83076731716844730703872
inch wide. It strips paint from
1/33230692686737082815536 inch to 1/16615346343368541407768 inch wide. It
strips paint from 1/66461385373474165631072 inch to 1/33230692686737082815536
inch wide. It strips paint from
1/132922770746942331262144 inch to 1/66461385373474165631072 inch wide. It
strips paint from 1/265845541493884662524288 inch to 1/132922770746942331262144
inch wide. It strips paint from
1/531691082987769325048576 inch to 1/265845541493884662524288 inch wide. It
strips paint from 1/106338201597553865009752 inch to 1/531691082987769325048576
inch wide. It strips paint from
1/212676403195107730019504 inch to 1/106338201597553865009752 inch wide. It
strips paint from 1/425352806385215460039008 inch to 1/212676403195107730019504
inch wide. It strips paint from
1/850705612770430920078016 inch to 1/425352806385215460039008 inch wide. It
strips paint from 1/170141122544861840015632 inch to 1/850705612770430920078016
inch wide. It strips paint from
1/340282245089723680031264 inch to 1/170141122544861840015632 inch wide. It
strips paint from 1/680564490179447360062528 inch to 1/340282245089723680031264
inch wide. It strips paint from
1/136112898039889472012556 inch to 1/680564490179447360062528 inch wide. It
strips paint from 1/272225796079778944025112 inch to 1/136112898039889472012556
inch wide. It strips paint from
1/544451592159557888050224 inch to 1/272225796079778944025112 inch wide. It
strips paint from 1/108890394319115577610048 inch to 1/544451592159557888050224
inch wide. It strips paint from
1/217780788638231155320096 inch to 1/108890394319115577610048 inch wide. It
strips paint from 1/435561577276462310640192 inch to 1/217780788638231155320096
inch wide. It strips paint from
1/871123154552924621280384 inch to 1/435561577276462310640192 inch wide. It
strips paint from 1/174224630910588

sions as to their center-to-center distance, it is best to drill the last hole undersize, insert a temporary plug, and test for the proper span.



Autogiro Model Drops from Kite String

Sept. 1931 A small autogiro to fly from your kite string can be made from thin balsa and a stick. Make the four revolving blades as shown, and fasten them to the stick with a glass-headed pin so that they will turn freely in the wind. The blades should be very slightly twisted, all in the same direction. A thin balsa fin prevents the stick from turning. Make the hook from a wire paper clip, bent so that it can be dislodged easily when the kite string is jerked. The autogiro will slide all the way up the kite like a paper "message," and then float down when it is jerked loose.

Ice Used in New Method of Bending Metal Tubes

Mar. 1926 When bending small-caliber metal tubes, the common practice is to fill the tube, before bending, with molten resin, paraffin, or some metal alloy of low melting point. This prevents flattening the tube. A new method simplifies removal of the filler after bending. The tube to be bent is filled with water

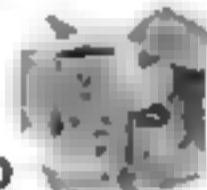
Choose one of these "PROFIT MAKERS" for success in Arc Welding

1 Your own electric power plus arc welding!

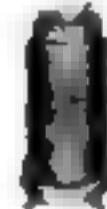
AC-AC Generator Only for building your own portable, AC welder—AC power plant.



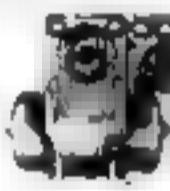
2 AC-AC Gas Drive— 200 amp arc welder and stand-by power unit



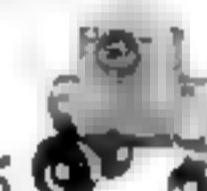
3 Industrial AC—arc welder for heavy duty welding.



4 AC Welder—designed for shops with single phase power supply.

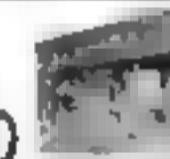


5 Electric Drive—for production and maintenance welding.



6 Generator Only—to build up your own portable gas engine welder.

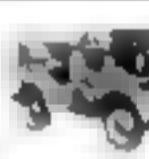
7 Welder & Power—A welding generator with 1 to 3 KW aux. D. C. power.



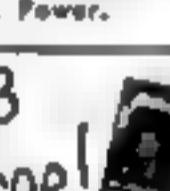
8 Gasoline Engine Drive—arc welder for heavy duty welding in field.



9 Weldmobil—the complete portable welding shop for any welding job.



10 Gas Drive Welder—with DC Power to handle welding and furnish Electric Power.



11 Gas Drive Arc Welder—with Auxiliary DC Power Generator for welding and power.



12 Hobart Trade School—most modern and efficient available. Non profit Covers all welding



13 "West Pocket Guide"—contains useful data for welders. Charts, symbols, etc.



HOBART BROTHERS COMPANY
Box P-88, Troy, Ohio

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"One of the World's largest builders of Arc Welders"

Without obligation send me complete information on the items I've checked by number.

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|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
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NOW

THE JIFFY METAL CABINET WITH RUSTPROOF ALUMINUM DRAWERS

32 DRAWER UNIT — \$8.95

POSTAGE PAID

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APPROXIMATE
SIZES
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11 $\frac{1}{2}$ " Deep
23 $\frac{1}{2}$ " Wide
6" Long

32 DRAWER UNIT
6" Deep
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13 $\frac{1}{2}$ " High

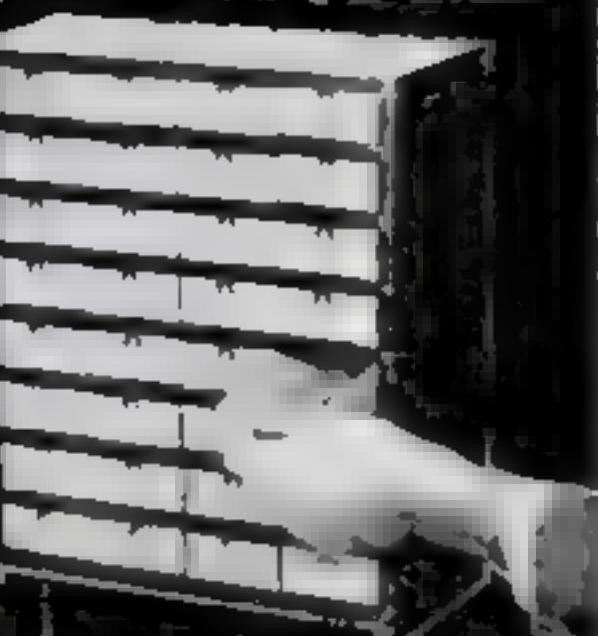
64 DRAWER UNIT
6" Deep
23 $\frac{1}{2}$ " Wide
13 $\frac{1}{2}$ " High

AND STILL AVAILABLE

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for home or shop,
the handy way to
keep small parts,
washers, nuts, bolts,
nails, screws, etc.

Solid one-piece aluminum drawers for greater strength and long life—and still at low cost. So handy to keep office, shop, work bench, household and hobbyist needs at your fingertips. Spot welded steel cabinet, enamel finish, and metal flange drawer guides.

32-Drawer Unit — \$8.95. 64-Drawer Unit — \$15.95. Postage Paid. Send check or money order. No C.O.D.'s, please. Add 3% sales tax for Ohio orders.

THE JIFFY METAL CABINET WITH LAMINATED FIBREBOARD DRAWERS

Same steel cabinet as above with covered fibreboard drawers. Suitable for most home needs. Thousands in use. 32-Drawer unit — \$5.95. 64-Drawer unit — \$9.95. Postage Paid. Check or money order. No C.O.D.'s. Add 3% sales tax for Ohio orders.

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DEPT S • BOX 508 • CANTON, OHIO

NOW YOU CAN DRILL YOUR OWN WELLS!

Sturdily Made—Hundreds of satisfied customers. Purchased and used by U. S. Dept. of Agriculture, U. S. Navy and many foreign countries.

Fully Guaranteed

Price Complete

\$385.00

Less Motor

F.O.B. Factory

Price includes drill, box and 100' cable. 200 ft. of additional length available at extra cost.



Drill your own wells for that needed water—as many as you need—outside—in the cellar—in the barn. The new improved CONSOL Drillier—1948 Model—is equipped with a special replaceable Drill Head. It will drill through many feet of solid rock without resharpening. Simple to operate, easy to set up. Do the work yourself at small cost.

We offer 3/4 H.P. Electric Motor or 1 1/2 H.P. Gas Engine to operate the "CONSOL" Well Drill at 20 strokes per minute.

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DRAINS CELLARS, WASH TRAYS CIRCULATES OIL

Pumps 1800 GPH 300 gal. 30' high, uses $\frac{1}{2}$ to $\frac{1}{4}$ HP motor. Will not clog. \$6.50

Postpaid if cash with order.
(Add 5% for West of the Mississippi.)

Thousands in use since 1936
LABAWCO PUMPS, BELLE MEAD 3, N. J.

WHY PAY MORE?

Tube Given With Every Tire

Everybody Deduct 10%
SEND THIS AD WITH ORDER

Buy used HIGH ORIGINAL TREADS. Buy in CONFIDENCE. Safe! Dependable Standard Brands GUARANTEED to give A-1 SERVICE. Positively Not Re-capable.

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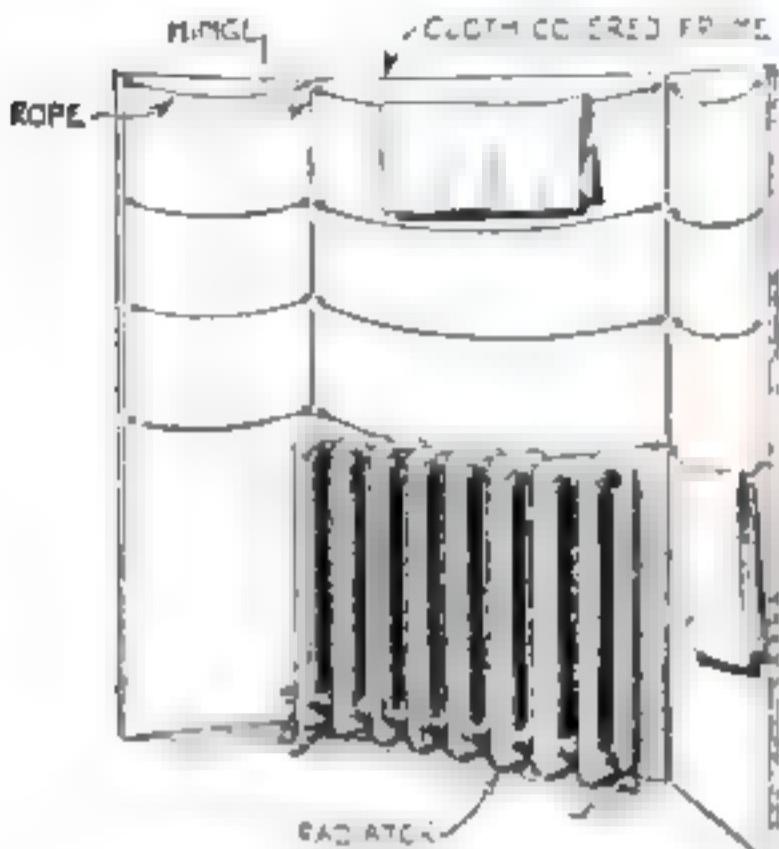
750-20 MILITARY 8 PLY . . . \$12.15

5 million tires shipped to satisfied customers. Tires will guarantee you. Orders Rushed. Send Money Order or Check.

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and then frozen in a refrigerating solution. The ice prevents flattening of the tube in bending. Afterward, the ice is melted and the water is blown out.



Wet Clothes Are Quickly Dried on Frame Over Radiator

Jan. 1922 In many a steam-heated apartment where there is no coal range in the kitchen, it is difficult to dry clothes when damp weather prevents use of the outdoor line. With this framework, however, any radiator may be transformed temporarily into a steam drier. The drier is made of three frames of narrow strips of wood hinged together. Ropes are attached for hanging the clothes, and the whole framework is covered with white cotton. When in use, the drier is opened to surround the radiator on three sides; when not in use, it may be folded up for storage in small space.

New Trick for Tool Grinder

June 1926 Many ways of utilizing an old tool grinder will suggest themselves to those who have one but who do not possess a lathe. It will be found extremely useful, for instance, when painting small wheels for toys, especially the tires. These wheels can be made from spools, which will fit over the spindle of the grinder. A narrow, even band of color can be applied merely by holding the brush against the wheel while it revolves.

An advertisement for Safticycles. At the top, the slogan "THE SAFEST WAY TO GET WHERE YOU'RE GOING" is displayed. Below this is a black and white photograph of a man wearing a helmet and goggles, riding a Safticycle. The motorcycle has a large front wheel and a smaller rear wheel. To the right of the motorcycle, a circular price tag shows "\$165⁰⁰ AND UP" with "PLUS FED. TAX" written below it.

Safticycle

333 Miles for \$1.00

America's Thrift Choice - combines lowest purchase price with "rock bottom" upkeep costs for convenient, practical work-a-day transportation • 100 MPG - 35 MPH - "built in" safety features • Large wheels - no "death grip" steering • Long wheelbase, no "bobble", no "bounce"

FREE
literature on
all models.

Dealer Inquiry Invited

If no dealer - write
SAFTICYCLES, INC.
LaCrosse, Wisconsin



**Now—a
TELEPHOTO
LENS
FOR
REFLEX
CAMERAS**

**THE NEW
MORTON REFLEX MAGNI-FAR**

For practically all reflex cameras (as illustrated above) increased focus length diminishes distance results in finer portraiture. Fits over both focusing and taking lenses. Takes Standard Series VII filters and shades. Complete with framing mask to eliminate guesswork. See your dealer or write Dept. A49S.

THE Morton COMPANY

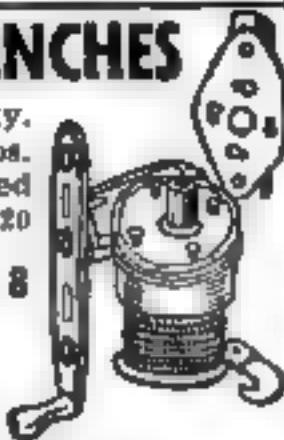
26 SO. 6TH ST. • MINNEAPOLIS 2, MINNESOTA

REAL SURPLUS VALUES

New BOMB HOISTS-WINCHES

New shipment. 2,500 lb. lifting capacity. Small, compact. Light weight, only 18 lbs. 20 feet of cable with hook. Three speed crank handle. May be motor driven. 20 to 1 ratio. Release pin type cable reel out. Load held any position. FOB, K. C., Mo. Only \$14.98

Mounting Bracket & Hanger for quick attachment. \$1.98



EMERGENCY SUPPLY TANK

Fill at any gas station. 150 lbs air at 5 flat tires. Inflates rubber boats. Use for touch-up spray jobs, tire service truck, air horns, dust out motors, machinery, etc. Shatterproof 12"x24" stainless steel tank with carry handle, check valve, two foot hose and tire filling chuck. \$7.95

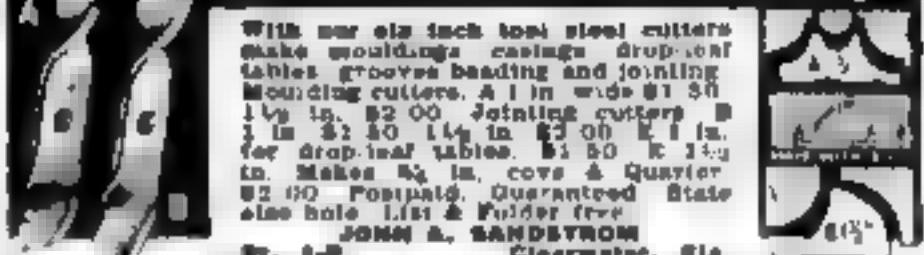
Tank only 12"x24", tapped each end $\frac{1}{4}$ pipe thread. 600 lb pressure. Build your own ideal for paint spray air receivers, net floats, buoys, etc. Each. \$4.75
Small size tank. 6"x24" Only. \$2.00

Prices FOB, K. C. Write for new catalog.

MIDWEST SURPLUS SALES CO. 3531 P.T. Indiana, Kansas City, Mo.

USE YOUR BENCH SAW

FOR JOINING & CUTTING MOULDINGS



With our six inch tool steel cutters make mouldings, casings, drop leaf tables, grooves, beading and jointing. Moulding cutters. A 1 in wide \$1.50 1½ in. \$2.00 Jointing cutters. 3 1 in. \$2.50 1½ in. \$3.00 4 1 in. for drop leaf tables. \$1.50 6 1½ in. Mitered. \$2.00 Postpaid. Guaranteed. State also hole list & folder free. JOHN A. SANDSTROM, P.O. Box 84, Clearwater, Fla.

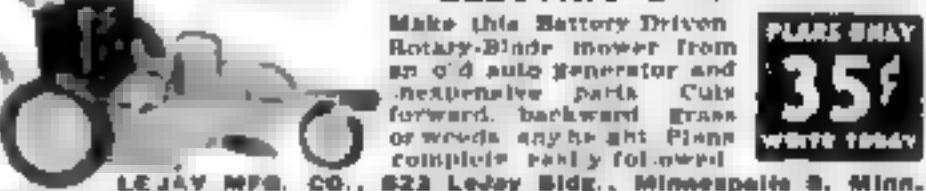
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BLOWER ONLY \$10.00**

SINGLE EXHAUST BLOWER 12" LINES APPROX 200 FT. FT AIR PFT. 1000 CFM. Body is made of aluminum with heavy household tools. It's built for that. Housing is solid cast aluminum to last indefinitely. 110 V. A.C., 30-40 c.p. on 1/20 duty motor.

INCORPORATE EXHAUST BLOWER WITH HEAVY CAST ALUM. HOUSING. ONLY \$16.00. ADD AIR HANDLING. \$1.00 EACH OF THESE. Head check. N.O. Heavy Back Gage. Rates. Free literature.

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BUILD AN ELECTRIC LAWN MOWER



Make this Battery Driven
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an old auto generator and
inexpensive parts. Cuts
forward, backward, grass
or weeds, any height. Plans
complete. Ready to own.
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WORLD WIDE**

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TABLE MODEL TILT-ARBOR SAW

IMPROVEMENTS BRONZE BEARINGS OR DOUBLE
SHIELDED BALL BEARINGS, BITE WITH THE PATENTED
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MODEL #2021X AS SHOWN WITH COMPLETE MITRE GAUGE Precision etched scales show angle or mitre gauge and saw cradle. STEEL BAR RIP FENCE ALUMINUM SAW INSERT AND GUARD STEEL SPLITTER BALL BEARING TRANS-AXIAL DRIVE $\frac{5}{8}$ " GROUND ARBOR "COMPO" OIL IMPREGNATED BRONZE BEARINGS WITH OIL CHAMBER AND CUP, (OR, DOUBLE SHIELDED BALL BEARINGS, \$5 EXTRA) TABLE IS 18" x 18" BUILT IN SWITCH Depth of Cut $2\frac{1}{2}$ " Shipping WL 110 lbs. Requires $\frac{1}{2}$ or $\frac{3}{4}$ H.P. Motor.

BALL BEARING FLOOR MODEL WITH 18" x 32" TABLE INCLUDING EXTENSION. \$70.50

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Aluminum Guard easily
removed for cleaning

**TABLE
18" x 16"**

**BRONZE BEARINGS
\$44.95
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Heavy Duty & Motor**

**SAW BLADE TIPTS TO 50°
TABLE STAYS LEVEL**

MAKE \$ MORE MONEY

Applying or Selling

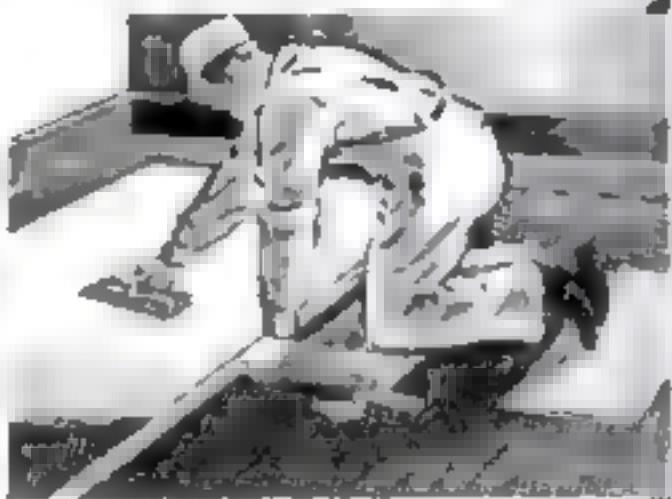
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A General Purpose Magnesium Oxychloride Flooring

THE MODERN PLASTIC FLOORING

EASY TO APPLY

Here's your opportunity to get into business for yourself applying or selling Corkstone, the economical, top-grade plastic flooring. Plenty of profit. Act without delay!



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DEEP TONE Dual Mufflers for Ford, Mercury

Scientifically designed end-to-end muffler reduces back pressure. Greater power, speed, and economy. Now in Anti Deep Tone places your car silent. Heavy blowout-proof construction. Rugged steel tube throughout. No aluminum.

Simplified installation. No cutting, no holes to drill. Rubber mounted clamps eliminate usual trouble. Complete with all hardware, brackets, etc. Order direct and save. State year and model. Send C.O.D. from Los Angeles. Price \$22.

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These asbestos mitts for handling hot metal molds and shapes are reversible to fit either hand. Both sides quilted, won't shred or fray on rough, jagged material. Double wear, double life. Wool lined. All seams double stitched. The answer to troublesome problems. Discounts for quantities. One of 1200 production-speeding, time-saving safety gloves, aprons, sleeves, spats, etc.

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TAKE a new kind of tour this year! Leave cities, crowds, congested highways, and dull care behind. Go "gypsying" . . . with a Harley-Davidson! See the real America of picturesque back-country roads, breath-taking mountain trails, hidden lakes, out-of-way towns, hard-to-reach historic places, rare beauty spots. Enjoy fun and thrills you've never known before . . . at exciting race meets, endurance runs, hillclimbs. There's no sport like motorcycling, no fun like riding a swift, powerful Harley-Davidson. And it's so easy to own your own! See your dealer today. Mail the coupon now.



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Send free copy of ENTHUSIAST magazine, filled with motorcycle action pictures and stories; also literature on latest models.

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New IMPROVED Electric MOTO-SAW

Only \$5.85
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SAFE AS A HAND SAW
JUST GUIDE IT!

Moto-Saw cuts wood, metal, tile, brick, stone, etc. Guide it with your hands. Guide it with your fingers. Guide it with strokes a minute so fast the blade seems to stand still. Sturdily built only two moving parts. Never needs oiling. Easily cuts third rate designs so smooth it eliminates sanding. Novice or craftsman a thrill awaits you when you get a Moto-Saw in your hand.



No Limit to Length of Stock it Will Cut. Saws to Center of 15 Widths.

THOUSANDS OF SATISFIED USERS
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It is fast. Cuts up to 100 ft. average in 1 min. Cuts 10 ft. up to 10 ft. wood. Operates on 110-120 V. 50 or 60 cycle alternating current. If your dealer does not yet have Moto-Saw send us \$5.85 and we'll pay postage. Or send \$1.00 plus postage. MONEY BACK if not delighted after 3 days' trial.

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Nation's greatest bargains in 110-volt 60-cycle, 2500-watt power plants. Briggs Engines. Ideal for farmers, contractors for full time or emergency power! Cost Govt. \$535.1 New plants \$265.00 pre-paid. Fully reconditioned plants \$225.00 pre-paid. 2500-watt famous Salsbury gas engines 6 1/2 H.P. \$22.00 (cost \$162.00) Satisfaction guaranteed. Free Catalog.

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BUILD YOUR OWN FAN



One-piece cast aluminum propellers for cooling and ventilating.

| Size | Polished 2-Blade | Unpolished 2-Blade | Polished 3-Blade | Unpolished 3-Blade | Price |
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| 13 | \$1.00 | \$1.00 | \$2.50 | \$2.50 | 12 1/2 |
| 18 | \$1.75 | \$1.75 | \$3.00 | \$3.00 | 19 1/2 |
| 20 | \$2.00 | \$2.00 | \$3.25 | \$3.25 | 20 1/2 |
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Write for pamphlet on larger fan blades, wire guards, fan bases, short or pillow blocks, exhaust fan frames, etc. Shipped prepaid if money and all other items.

Dealers write for discount.

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FLASH THAT VOLTAGE

Turn that knob. Instantly read 90 voltage right off dial. MINI-VOLT measures 65 to 600 AC & DC. Tells whether AC or DC. Virtually burnout proof. Guaranteed for 10,000 hours' operation. Durable case. 12" flexible test leads and test probe. A must in electrical and radio work. Only \$2.50 postpaid!

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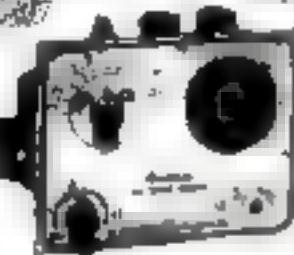
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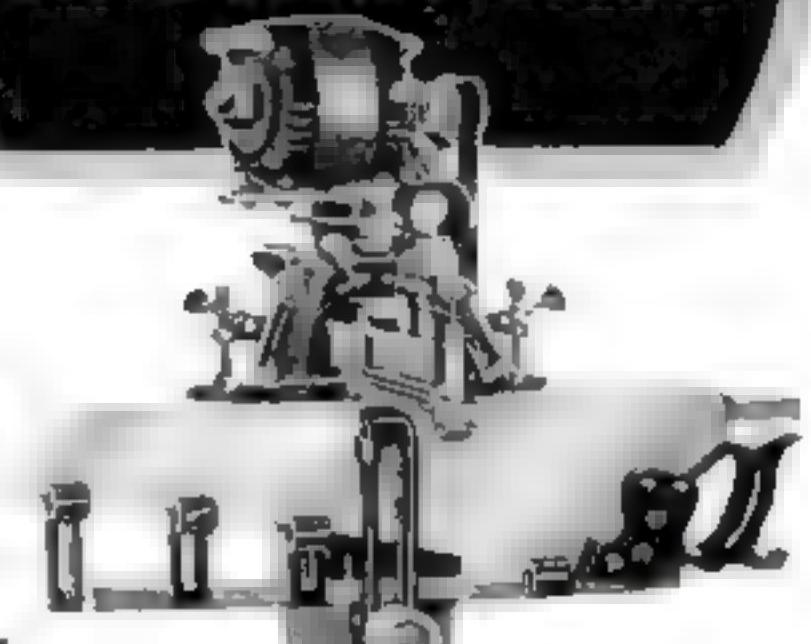
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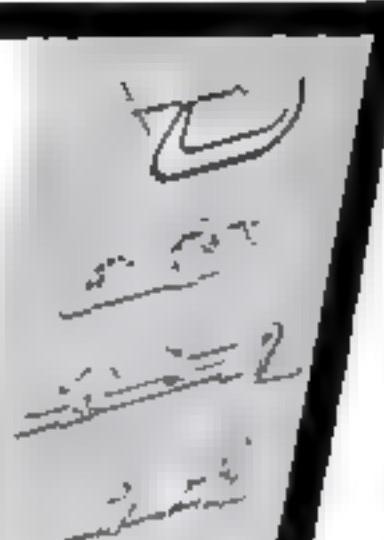


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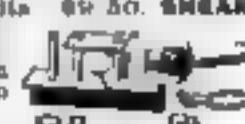
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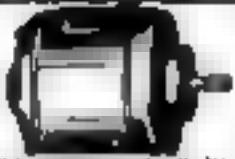
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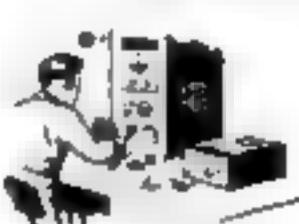
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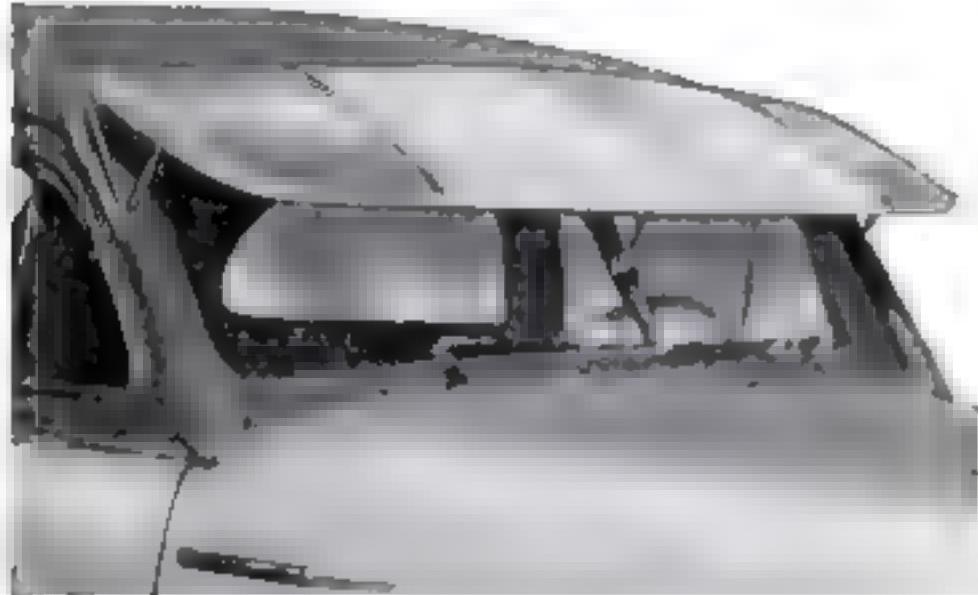


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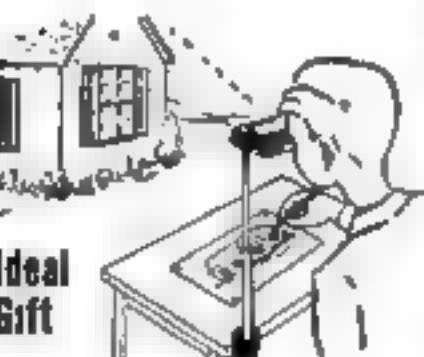
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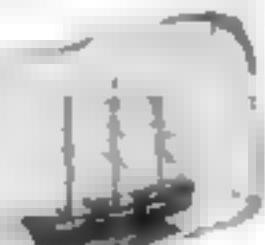
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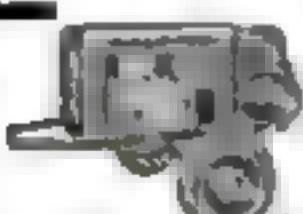
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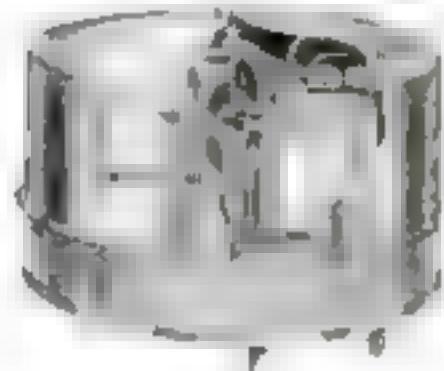
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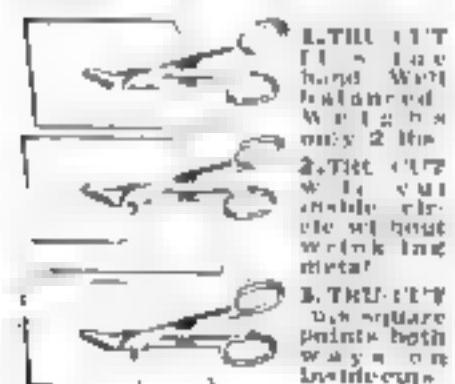
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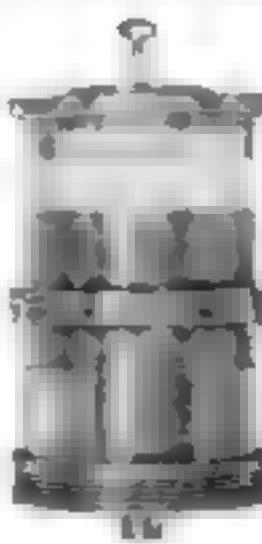
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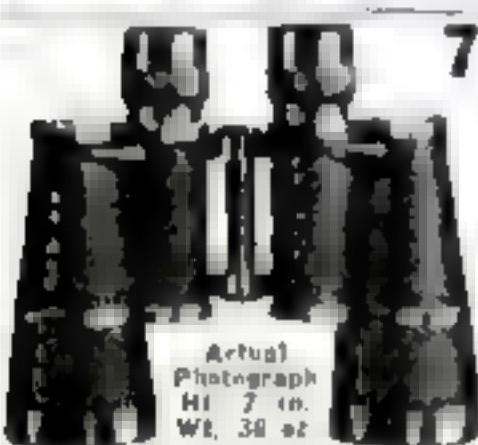
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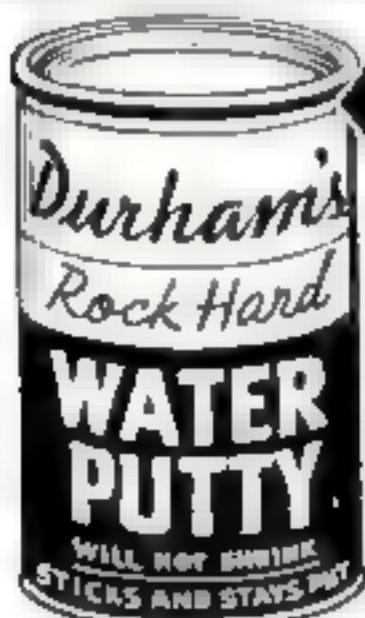
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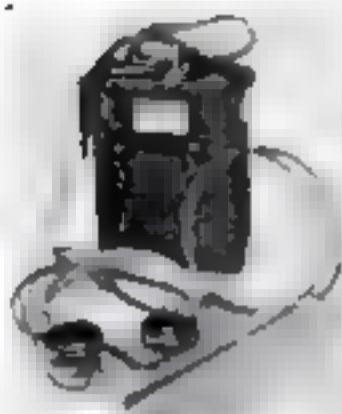
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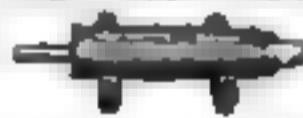
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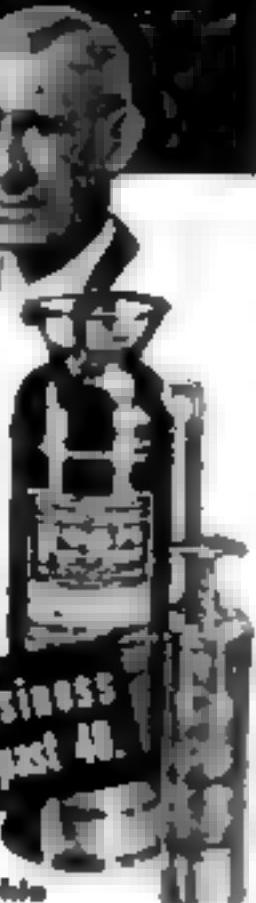
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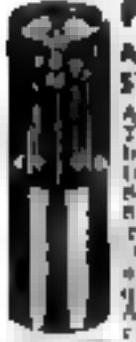
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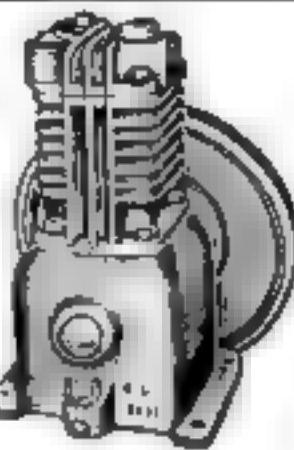
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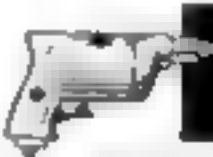


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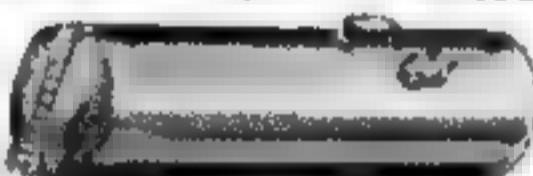
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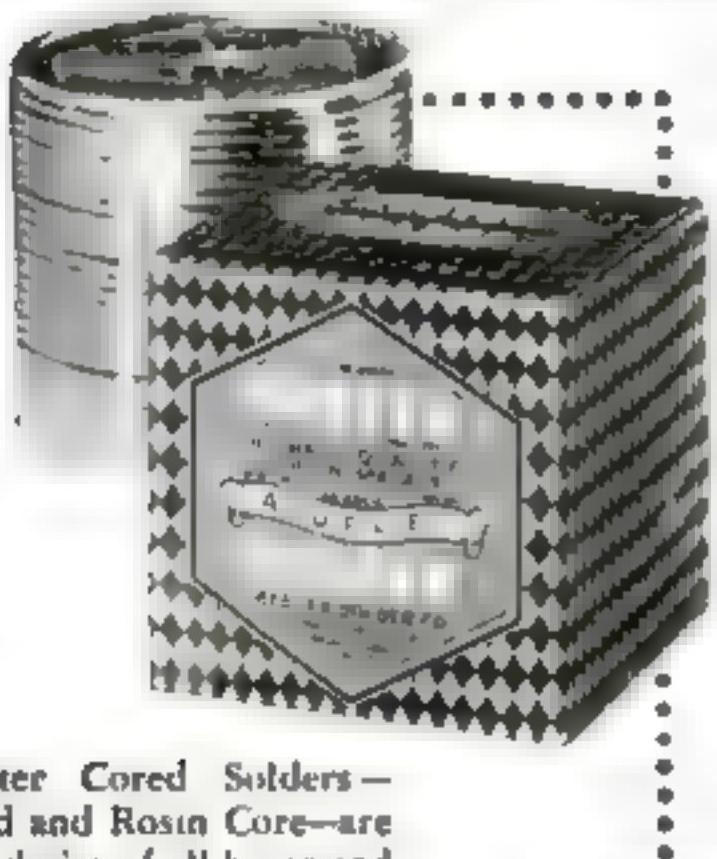
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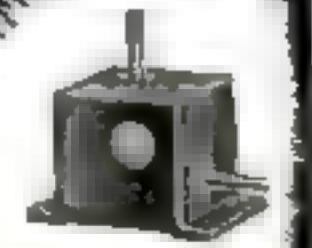
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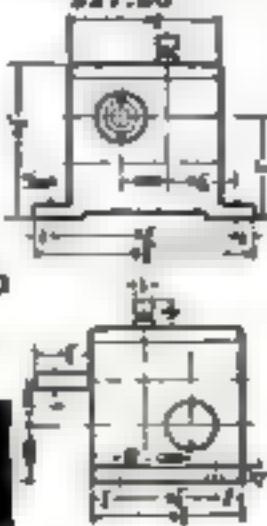
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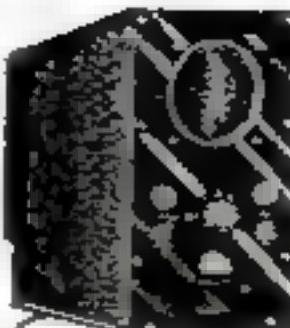


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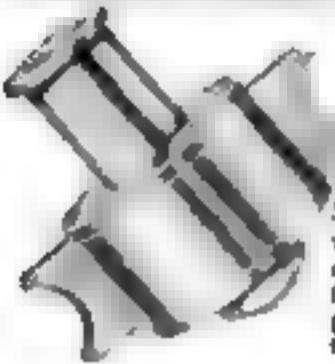
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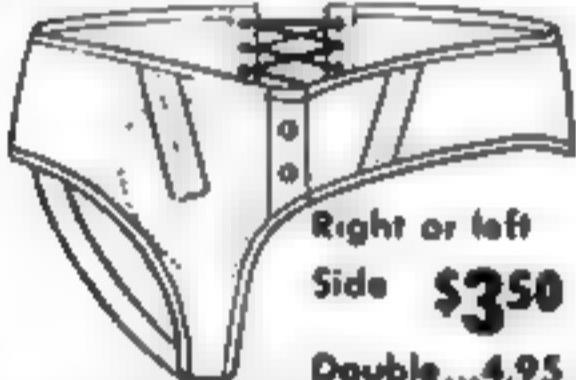
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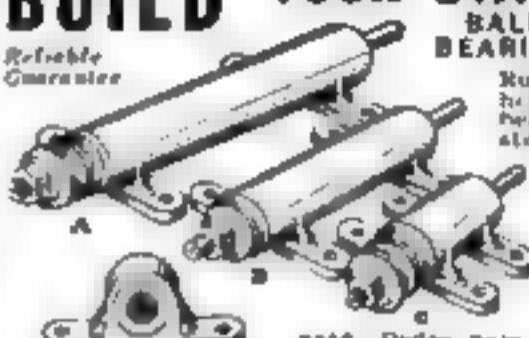
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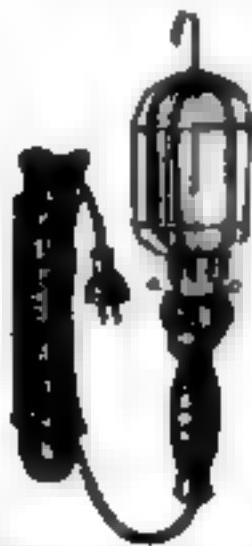
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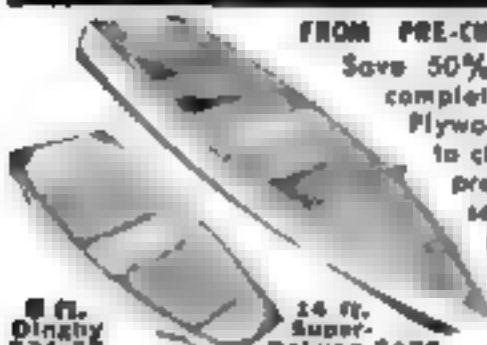
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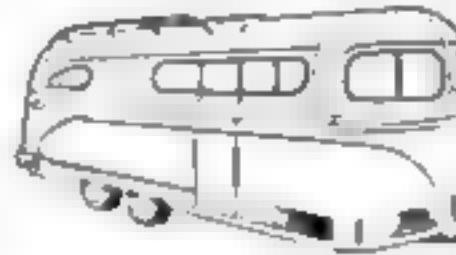
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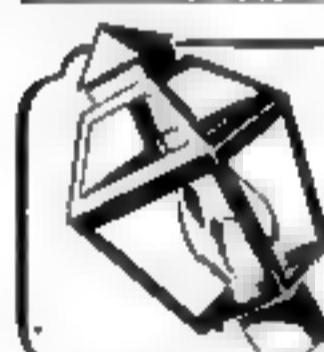
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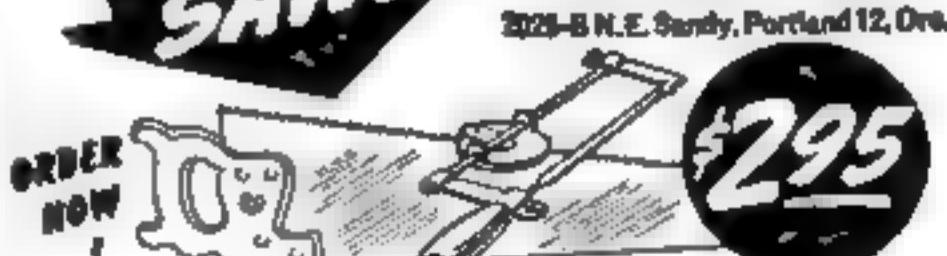
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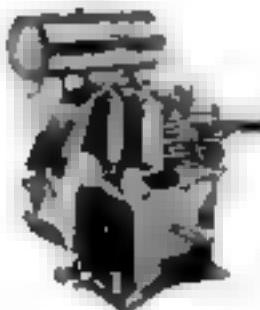
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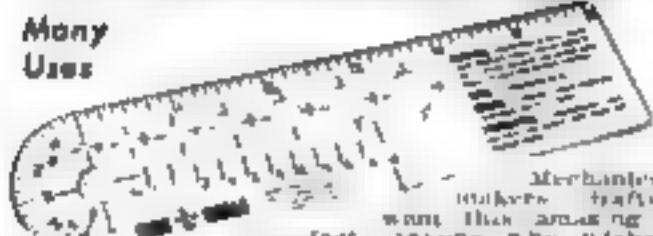
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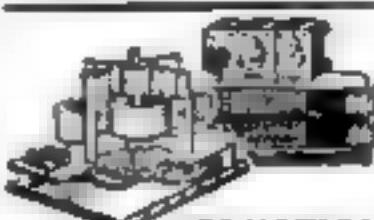
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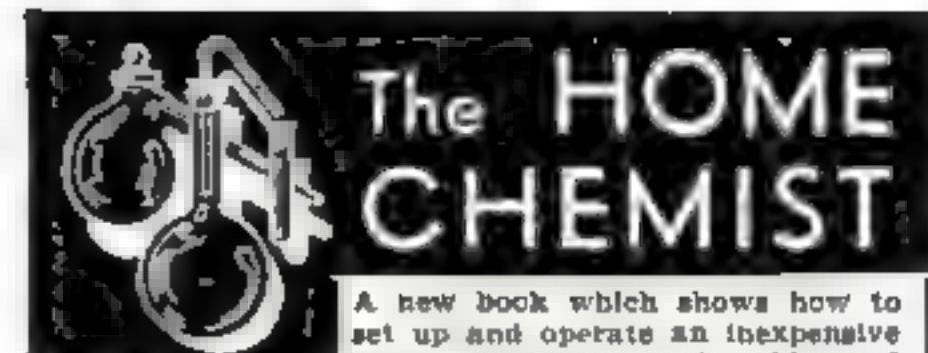


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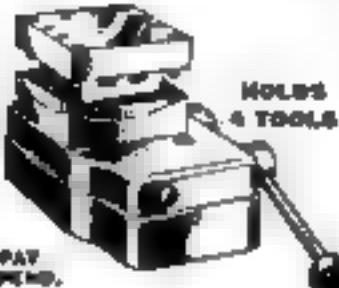
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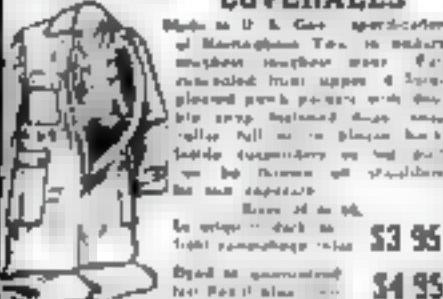
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NEW 1 Piece COVERALLS



Model A U. S. Govt. Specification
Made of Heavy Weight
Woolen Cloth over
Cotton Twill
Lined with
Silk Lining
Size 40 to 46.
In sets of 2 each
Light Weight
\$3.95
By set of four
New P. O. Box 6200
\$4.95

NEW DUST RESPIRATORS



200,000 in 5 different
types with adjustable head bands
By Valve Type
29¢ each

In lots of 10, 25 or 100 or more \$19.95.

FOR PNEUMOCONIOSIS—producing
dusts, road dusts, shale & clays, etc.
most produced in crushing, mining road
building, abrasing, turning, drought
planting, spreading etc. Ideal for Farm,
Mill, Factory, Garage, Foundry.

COMFO- RESPIRATOR

dual dust Style 814-
2-02 with 10 extra
filters to \$1.50 value.
\$1.59 each



WILSON CO. dual dust type, 730 with
5 extra filters to appearance
size 814-2-0
\$1.29 each

AMERICAN OPTICAL CO.

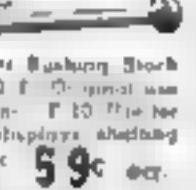
RESPIRATOR

Style 8-9-00 which
completely keeps all
dust out including
dusts, road dusts, shale
& clays, etc.
\$59¢ each

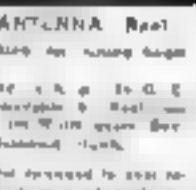


MICARTA TUBE

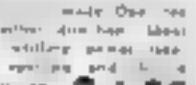
Ideal for insulation of insulation Stock
16 ft. x 1" wall x 1" O.D. Original was
used for insulation on
new engine displays, shipbuilding
airplane buildings, etc.
59¢ each



Burdie ANTENNA ROD
Used for Auto or Marine
purposes
Priced by the foot
In 6 ft. & 10 ft. lengths
10 ft. long
\$1.00 each
Burdie



A TRENCH KNIFE
\$4.29



RADIO HEAD
SET
AM FM + with
Leather
Sponge Rubber
Pad &
Wonderful Bag
\$1.00



A WONDERFUL PAL FOR THAT TRIP!

New U. S. Officers
THERMOS FOOD
CONTAINER

Space Food Kit in Field, 3 piece
permanently retaining 1 1/2 Quarts
Pyrex Baking Glass, Insulated
vacuum and 1 Quart Thermos
retained container. All in
one compact kit. Insulated
well above liquid temperature.
Kerosene, Kerosene
heat for the Space
Food Container
New & Improved
One C. O. D. \$1.00
Available on C. O. D.
\$12.95



New Navigator Military Compass
The U. S. Army's 100% New
Rubber Case, running compass
with a leather belt. It will fit 2 persons
and never be disappointed with
anywhere you go.

\$17.95

MESS TRAY
Compartments made
from aluminum plate
Rubberized insulation
covering some dish
washing. New at
Bargain Home
of roughing
83¢
New
59¢

SLEEPING BAG
New 100% Wool
Sleeping Bag 20 degrees
F. 30 degrees
F. 40 degrees
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The Hanson family of "I Remember Mama" faced the future with confidence—a confidence all due to Mama. "If anything goes wrong," said Mama, "there's always my Bank Account to pull us through."

Things worked out fine for the Hansons. And they never realized that Mama's Bank Account was Mama's own myth.

But the average family can't be fooled with a myth. The average family needs real savings,

real security protecting them.

That's why so many families have begun to save the automatic, worryless way—with U. S. Savings Bonds that pay back four dollars for every three in just ten years.

And to make it simpler still, your government offers you two fine plans for their purchase: (1) The Payroll Savings Plan at your firm. (2) For those not on a payroll, the Bond-A-Month Plan at your bank.

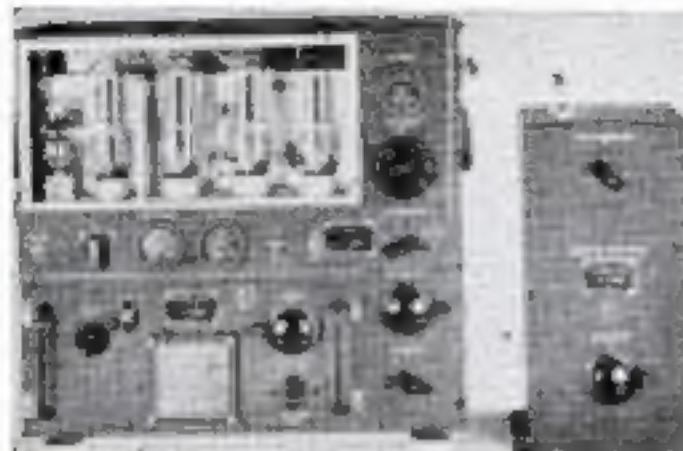
AUTOMATIC SAVING IS SURE SAVING—U.S. SAVINGS BONDS



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Magazine Publishers of America as a public service.



RADIOMEN'S HEADQUARTERS • WORLD WIDE MAIL ORDER SERVICE!



"B" — uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA from either 12 or 24 volts DC (specify). Complete instructions are furnished to operate

GENERAL ELECTRIC 150 WATT TRANSMITTER

COST THE GOVERNMENT \$1800.00

COST TO YOU BRAND NEW \$67.50!!!

This is the famous transmitter used in U.S. Army bombers and ground stations, during the war. Its design and construction have been proved in service, under all kinds of conditions, all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Here are the specifications:
FREQUENCY RANGE: 200 to 500 KC and 2500 to 12,500 KC. (Will operate on 10 and 20 meter band with a slight modification for which diagrams are furnished.)
OSCILLATOR: Self-excited, thermo compensated, and hand calibrated.
POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna.
MODULATOR: Class set from 110V AC. SIZE: 21 1/2x24x9 1/2 inches. Total shipping weight 200 lbs., complete with all tubes, dynamotor power supply, seven tuning units, antenna tuning unit and the essential plugs.

GENERAL ELECTRIC RT-1248 15-TUBE TRANSMITTER-RECEIVER

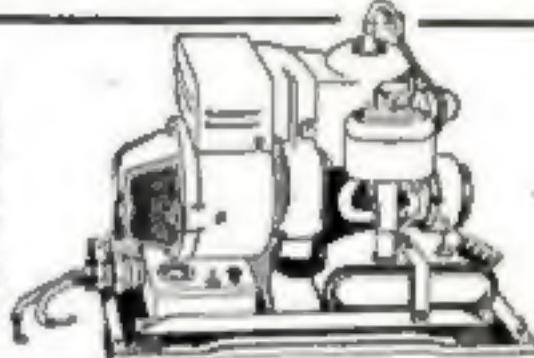
TERRIFIC POWER—(20 watts) on any two instantly selected, easily pre-adjusted frequencies from 435 to 500 Mc. Transmitter uses 5 tubes including a Western Electric 316 A as final. Receiver uses 10 tubes including 955's, as first detector and oscillator, and 3-7117's as IF's, with 4 slug-tuned 40 Mc. IF transformers, plus a 7H7, TEC's and TFT's. In addition unit contains 8 relays designed to operate any sort of external equipment when actuated by a received signal from a similar set elsewhere. Originally designed for 12 volt operation, power supply is not included, as it is a cinch for any amateur to connect this unit for 110V AC, using any supply capable of 400V DC at 135 MA. The ideal unit for use in mobile

stationary service in the Citizen's Radio Telephone Band where no license is necessary. Instructions and diagrams supplied for running the RT-1248 transmitter on either code or voice in AM or FM transmission or reception, for use as a mobile public address system, on 80 to 110 Mc. as an FM broadcast receiver, as a Facsimile transmitter or receiver, as an amateur television transmitter or receiver, for remote control relay hookups, for Geiger-Muller counter applications. It sells for only \$29.95 or two for \$53.90. If desired for marine or mobile use, the dynamotor which will work on either 12 or 24V DC and supply all power for the set is only \$15.00 additional.

PE-109 32-VOLT DIRECT CURRENT POWER PLANT

This power plant consists of a gasoline engine that is direct coupled to a 2000 watt 32 volt DC generator. This unit is ideal for use in locations that are not serviced by commercial power or to run many of the surplus items that require 32V DC for operation. The price of this power plant is only \$59.95. We can also supply a converter that will supply 110V AC from the above unit or from any 16-32V DC source for \$12.95.

(Due to the fact that the PE-109 comes to us sealed in heavy steel strapped govt. cases we are unable to determine whether the individual units are new or used or what the condition is if used, and consequently must sell them as is. In general, they represent a terrific bargain.)



SOS EMERGENCY TRANSMITTER SOS

This is the famous Gibson Girl Transmitter that saved so many lives during the war. It is used as a distress call transmitter on boats and airplanes. The Gibson Girl is the easiest transmitter in the world to operate. No instruction or experience necessary. No external power supply required for operation. It is merely necessary to turn the crank on the top of the transmitter and power is generated and the distress signal is automatically sent out on the international distress frequency. Brand New Gibson Girl transmitter complete with tubes. \$9.95

Antenna Kit for Gibson Girl transmitter. This kit was designed to improve the effectiveness of the Gibson Girl Transmitter by increasing the range several times. The kit includes 200 feet of special antenna wire, two balloons for raising the antenna in calm

weather, two hydrogen generators to inflate the balloons, a special box kite for antenna erection in windy weather, and a searchlight, powered by the crank operated generator in the transmitter. Complete kit \$19.95

AUTO RADIO DEALERS! ATTENTION!

Nationally advertised brand of 1948 car radio which will fit practically any car and every pocketbook. Six tube superhet with three gang condenser and 6 1/2" speaker. \$22.25 for example, or 2 for \$40.97 each.

SENSATIONAL VALUE IN AC-DC POCKET TESTER

This analyzer, featuring a sensitive repulsion type meter housed in a bakelite case, represents the culmination of 15 years achievement in the instrument field by a large company specializing in electronic test equipment.

Specifications of the AC-DC

Model Volt-Ohm-Milliammeter:

AC Volts—0-25, 50, 125, 250

DC Volts—0-25, 50, 125, 250

Millidamperes AC—0 to 50

DC Milliamperes—0 to 50

Ohms Full Scale—100,000

Ohms Center Scale—2400

Capacity—.05 to 15 Mfd.

Total Price, prepaid anywhere in the U.S.A.—\$7.95.

Similar DC Meter, lacking the AC operated ranges of above, \$5.95 prepaid.



Terrific Value—Portable Electric Drill

(Sold at less than established factory price so we cannot mention brand name)

Only \$19.95 equipped with 1/4" Jacobs Geared Chuck and Key. Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch, natural grip handle, and balance like a six shooter. Precision cut gears—turbo type cooling blower—extra long brushes. No stalling under heaviest pressure because of powerful 110 Volt AC-DC motor and multiple ball thrust bearing. Other bearings self-aligning lifetime-lubricated Chrysler Ollite type. Made for toughest year-in and year-out service in plant or on construction jobs.



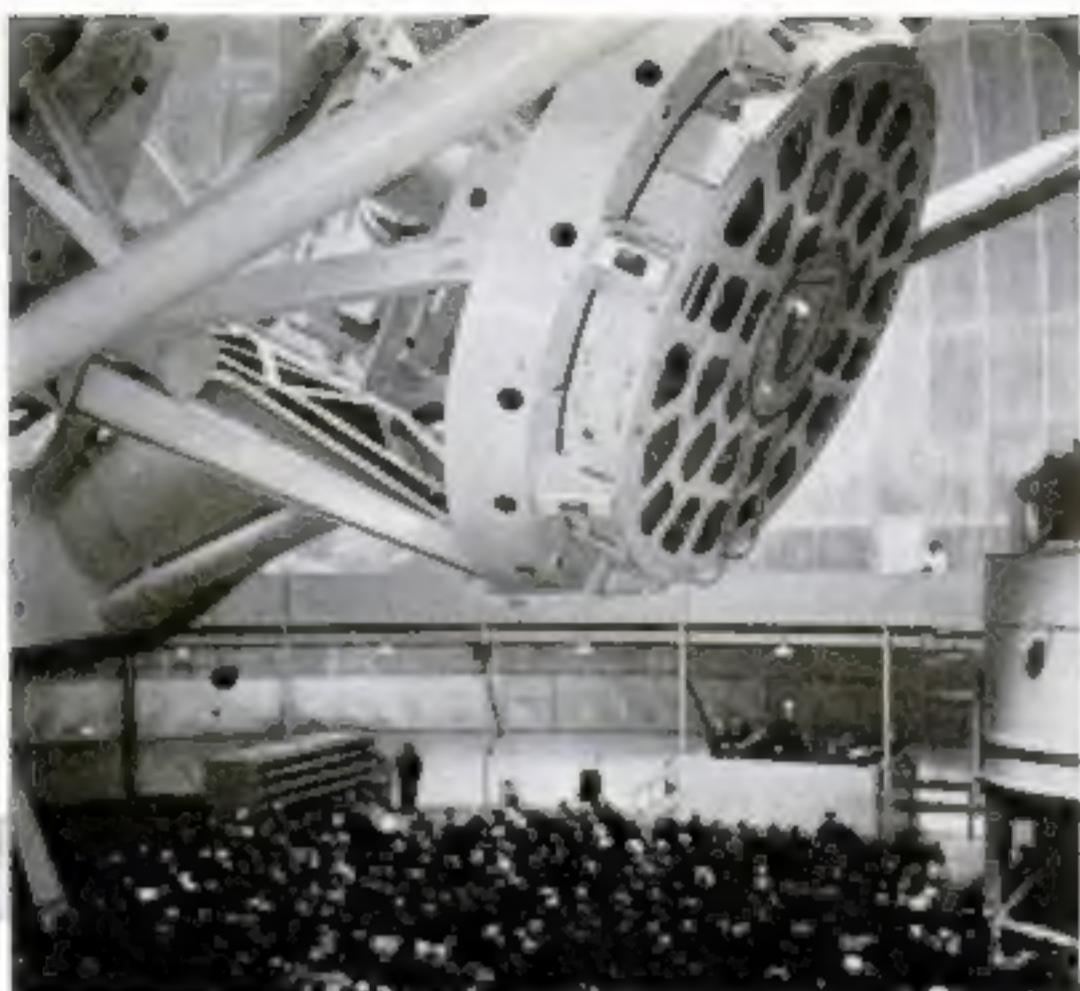
Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use. 25% deposit on C.O.D.'s. Full refund (less transportation) if not pleased with drill after trial.

CABLE ADDRESS
BUFRAD

Minimum order \$2.00—All prices subject to change—25% deposit with C.O.D. orders.

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 8S, BUFFALO 3, N.Y.

TO: Reader
FROM: Editor



Inside Palomar's dome (left), 800 people gathered for dedication of the Biggest Eye of all.

I Looked Through the Big Eye

I HAVE just come from enjoying an experience permitted to few laymen. I have looked through the eyepieces of the largest and newest telescope in the world, perched atop Southern California's Mount Palomar. I got a big kick out of it. And I think you would have, too.

The Big Eye was looking at Saturn. Its 200-inch mirror had gathered the light after its 900,000,000-mile journey into an image 700 times brighter than the view of Saturn you get with the naked eye. Around the greenish planet, for 50,000 miles on either side, circled a fantastic smoky corona.

Bringing in Saturn is of course child's play for the Big Eye. Dr. Ira S. Bowen, director of the observatory, can now photograph nebulae *six million times* farther out toward the fringe of the universe.

Does that word *fringe* sound strange to you? It should. It brings up the shocking idea that there may be a limit to space itself. Poking around Palomar, I found a lot of questions simmering in the minds of the astronomers there, questions that they hope the Big Eye will help to answer. For example, astronomers know that thousands of stellar systems larger than our own are rushing through space. How fast do they travel?

How were they formed? Are they running away from us? Will there be few left for our descendants to see some day?

Talk to the men of Palomar, as I did, and you soon learn that these aren't questions that concern the scientific highbrows alone. Those lonely night vigils on a mountaintop that are an astronomer's life touch every crossroads village in the world.

How? We are entering the atomic age. Maybe disintegrating atoms will power machines, furnish heat, run steamships. But the atom is also the building block of the universe. Photographs and spectroscopic studies some day may show us how the atom formed those distant heavenly bodies.

"How," asks Dr. Max Mason, chairman of the observatory council, "can you run a machine until you know HOW to run it?" With the giant telescope, Dr. Bowen will peer twice as far into the vitals of the cosmic machine as has been possible in the past. And in time more secrets of the cosmic machinery, brought to earth by the Big Eye, may find application in our day-to-day affairs.

Andrew R. Boone

NEW

AUTO-LITE

Resistor

SPARK PLUG

**NEW
BUILT-IN
"RESISTOR"
AIDS
PERFORMANCE**



New Auto-Lite Spark Plug Has Built-in "Resistor" That Helps Deliver Smoother Idling, Better Radio Reception—Gives Improved Economy and Longer Electrode Life



Gives smoother engine idling

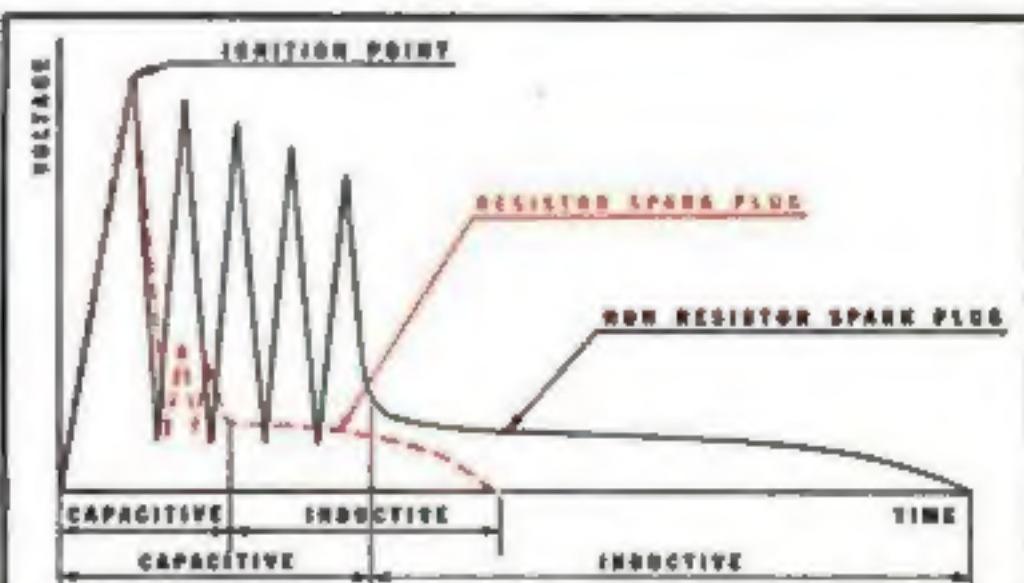
—because of the wider initial spark gap setting possible on the "Resistor" plugs. This assists in burning leaner mixtures, and reduces misfiring at idling and throughout the speed range.

AUTO-LITE Ignition Engineers, working with leading automotive manufacturers, have developed the new Auto-Lite "Resistor" Spark Plug with this built-in resistor for improved operation and economy. Regular type Auto-Lite Spark Plugs (patented U.S.A.) will continue to be manufactured.



Improves radio reception

—by suppressing spark plug interference with radio, radio-telephone, radar and television reception. (Under 35 mv/m from 540 kc. to 150 mc. at 50 ft.)



Reduces electrode gap growth

—by increasing electrode life up to 200% and more . . . due to the virtual elimination of the inductive component in the spark discharge.

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